Vertebrate Species at Risk at Onefour Research Sub-station, Alberta.

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Vertebrate Species at Risk at Onefour Research Sub-station Alberta.

Espèces de vertébrés en péril potentiellement présentes ou répertoriées à la Sous-station de recherches agricoles Onefour (Alberta).

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SUMMARY

This report reviews the records of vertebrate Species at Risk that could occur at the Onefour Agricultural Research Sub-station and determines which ones have occurred there and consequently are of management concern. The report focuses on vertebrates and omits insects and plants, except one insect and one plant since reports on their occurrence have been compiled recently. The focus species are those listed by COSEWIC and in the Species At Risk Act. We have also included three that are on the provincial SAR list.

The following COSEWIC-listed species occur at Onefour and are included in this report: Endangered: Swift Fox, Greater Sage-grouse, Mountain Plover, Piping Plover, Burrowing Owl, and Sage Thrasher; Threatened: Loggerhead Shrike, and Sprague's Pipit; Special concern: Ferruginous Hawk, Long-billed Curlew, Short-eared Owl, Greater Short-horned Lizard, Northern Leopard Frog, and Great Plains Toad. The following three species which are not covered under COSEWIC are "blue-listed" in Alberta and occur at Onefour: Plains Spade-foot Toad, Prairie Rattlesnake, and Western Hog-nosed Snake. In addition two non-vertebrate Species at Risk that occur at Onefour are included in an appendix: Endangered, Yucca Moth; Threatened, Soapweed (Yucca).

The report presents survey data from the past 4 years of research that CWS staffs have conducted at the Onefour Sub-Station as well as other anecdotal reports of species that we located and recommendations for future studies.

RÉSUMÉ

Dans le présent rapport, nous passons en revue les mentions d'espèces de vertébrés en péril potentiellement présentes à la Sous-station de recherches agricoles Onefour et nous dressons la liste de celles dont la présence a été confirmée et dont la gestion, de ce fait, soulève des préoccupations. Les espèces mentionnées sont presque exclusivement des vertébrés, à l'exception d'une espèce d'insecte et d'une espèce de plante, qui ont toutes deux fait l'objet d'un rapport confirmant leur présence tout récemment. Une attention spéciale a été accordée aux espèces dont le nom apparaît dans les listes du COSEPAC ou la *Loi sur les espèces en péril*. Sont également mentionnées trois espèces inscrites sur la liste provinciale des espèces en péril.

Les espèces suivantes sont considérées comme en péril par le COSEPAC et se rencontrent à la Sous-station de recherches agricoles Onefour : espèces en voie de disparition : renard véloce, tétras des armoises, pluvier montagnard, pluvier siffleur, chevêche des terriers et moqueur des armoises; espèces menacées : pie-grièche migratrice et pipit de Sprague; espèces préoccupantes : buse rouilleuse, courlis à long bec, hibou des marais, grand iguane à petites cornes, grenouille léopard et crapaud des steppes. Les trois espèces suivantes, qui ne figurent pas dans les listes du COSEPAC mais sont mentionnées dans la liste bleue de l'Alberta, sont également présentes à la Sous-station Onefour : crapaud fouisseur, crotale des prairies et couleuvre à nez retroussé. Enfin, deux espèces non vertébrées en péril présentes à la sous-station Onefour sont également

mentionnées en annexe : espèce en voie de disparition : teigne du yucca; espèce menacée : yucca glauque.

Nous présentons dans ce rapport les données recueillies par des membres du personnel de la Sous-station Onefour au cours des quatre dernières années de recherches et des rapports anecdotiques d'espèces que nous avons observées. Nous y formulons également des recommandations destinées à faciliter la réalisation des études futures.

TABLE OF CONTENTS

Summary i
Resume i
Table of Contents iii
List of Figures iv
List of Appendices v
1.0 Introduction 1
2.0 Study Area 2
3.0 Methods 4
    3.1 Survey Methods 4
    3.2 Data Analysis 5
4.0 Results 6
    4.1 Point Count 6
    4.2 AGRISID Data 6
5.0 Species Accounts 11
    5.1 Extirpated Species 11
        5.1.1 Black-footed Ferret 11
    5.2 Endangered Species 11
        5.2.1 Swift Fox 11
        5.2.2 Greater Sage-Grouse 12
        5.2.3 Mountain Plover 13
        5.2.4 Piping Plover 16
        5.2.5 Burrowing Owl 16
        5.2.6 Sage Thrasher 23
    5.3 Threatened Species 25
        5.3.1 Peregrine Falcon 25
        5.3.2 Loggerhead Shrike 26
        5.3.3 Sprague's Pipit 30
    5.4 Species of Concern 36
        5.4.1 Ferruginous Hawk 36
        5.4.2 Long-billed Curlew 37
        5.4.3 Short-eared Owl 39
        5.4.4 Red-headed Woodpecker 44
        5.4.5 Greater Short-horned Lizard 45
        5.4.6 Northern Leopard Frog 46
        5.4.6 Great Plains Toad 48
    5.5 Alberta "Blue-list" Species 49
        5.4.1 Plains Spadefoot Toad 50
        5.4.2 Prairie Rattlesnake 50
        5.4.3 Western Hog-nosed Snake 51
6.0 Recommendations 53
7.0 Literature Cited 54
8.0 Acknowledgements 60
9.0 Appendix 1-3 61

LIST OF FIGURES

Figure 1. Soil and landscape types at Onefour Agricultural Research Substation from AGRISID. 7
Figure 2. Distribution of Point Counts at Onefour in 2002 plotted on AGRISID landscape units....8
Figure 3. Distribution of Point Counts at Onefour in 2003 plotted on AGRISID landscape units....9
Figure 4. Distribution of Point Counts at Onefour in 2005 plotted on AGRISID landscape units....10
Figure 5. Location of Mountain Plover sightings at Onefour, 1971-2005. 15
Figure 6. Percent of point counts where Burrowing Owls were detected at Onefour in three years of surveys. 18
Figure 7. Location of Burrowing Owl nests in relation to AGRISID landscape units at Onefour in 2002. 19
Figure 8. Location of Burrowing Owl nests in relation to AGRISID landscape units at Onefour in 2003. 20
Figure 9. Location of Burrowing Owl nests in relation to AGRISID landscape units at Onefour in 2004. 21
Figure 10. Location of Burrowing Owl nests in relation to AGRISID landscape units at Onefour in 2005. 22
Figure 11. The number of active Burrowing Owl nests found at Onefour between 2002 and 2005....23
Figure 12. Location of Loggerhead Shrike nests in relation to AGRISID landscape units at Onefour in 2005. 29
Figure 13. Location of Sprague's Pipits in relation to AGRISID landscape units at Onefour in 2002. 32
Figure 14. Location of Sprague's Pipits in relation to AGRISID landscape units at Onefour in 2003. 33
Figure 15. Location of Sprague's Pipits in relation to AGRISID landscape units at Onefour in 2005. 34
Figure 16. Percent of point counts with Sprague's Pipits identified. 35
Figure 17. Number of Sprague's Pipits per point count at Onefour. 35
Figure 18. Percent of point counts where Long-billed Curlews were detected. 39
Figure 19. Location of Long-billed Curlews in relation to AGRISID landscape units at Onefour in 2002. 40
Figure 20. Location of Long-billed Curlews in relation to AGRISID landscape units at Onefour in 2003. 41
Figure 21. Location of Long-billed Curlews in relation to AGRISID landscape units at Onefour in 2005. 42

LIST OF APPENDICES

Appendix 1. Species Classifications by Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2001) 61
Appendix 2. Additional Species at Risk at Onefour 62
Appendix 3. UTM Co-ordinates for the location of Mountain Plover sightings at Onefour from 1979 to 2005... 64
Appendix 4. UTM Co-ordinates for the location of Burrowing Owl nests at Onefour in 2002 – 2005 66
Appendix 5. UTM Co-ordinates for the location of Loggerhead Shrike nests at Onefour in 2005 67
Appendix 6. UTM Co-ordinates for the location of Sprague's Pipit sightings at Onefour in 2002, 2003 and 2005 68
Appendix 7. UTM Co-ordinates for the location of Long-billed Curlew sightings at Onefour in 2002, 2003 and 2005 70

1. INTRODUCTION

With the passage of the federal Species at Risk Act, 2003, the federal government committed to protect listed species at risk (endangered and threatened) on federal lands. According to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC, see definitions in Appendix 1), there are currently 487 plant and animal species at risk in Canada. These Species-at-Risk (SAR) are listed in five categories: Special Concern, Threatened, Endangered, Extirpated, and Extinct. In this report, we consider those vertebrate species that fall into the first four categories – special concern, threatened, endangered, and extirpated – that occur on the Onefour Agricultural Research Substation in southeastern Alberta, hereafter known as Onefour.

The following vertebrate species are included in this report with the COSEWIC classifications as:

Extirpated:
Black-footed Ferret *Mustela nigripes*

Endangered:
Swift Fox *Vulpes velox*
Greater Sage-grouse *Centrocercus urophasianus urophasianus* subspecies
Mountain Plover *Charadrius montanus*
Piping Plover *Charadrius melodius circumcinctus*
Burrowing Owl *Athene cunicularia*
Sage Thrasher *Oreoscoptes montanus*

Threatened:
Anatum Peregrine Falcon *Falco peregrinus anatum*
Loggerhead Shrike *Lanius ludovicianus excubitorides*
Sprague's Pipit *Anthus spragueii*

Special concern:
Ferruginous Hawk *Buteo regalis*
Long-billed Curlew *Numenius americanus*
Short-eared Owl *Asio flammeus*
Red-headed Woodpecker *Melanerpes erythrocephalus*
Greater Short-horned Lizard *Phrynosoma hernandesi*
Northern Leopard Frog *Rana pipiens*
Great Plains Toad *Bufo cognatus*

The provincial government in Alberta has assigned a code to each species known to have occurred within the province (Alberta Natural Heritage Information Centre 2005). These fall into the following categories:
Red – a species considered to be at risk
Blue – a species that may be at risk

Yellow A – Sensitive species that are not currently believed to be at risk but may require special management because of concern for their long-term declines
Yellow B – Sensitive species that are not currently believed to be at risk but may require special management because they are naturally rare or are associated with deteriorating habitats.
The following three species, which are not covered under COSEWIC, are "blue-listed" in Alberta and potentially or actually occur at Onefour:
Plains Spade-foot Toad (*Spea bombifrons*), Prairie Rattlesnake (*Crotalus viridis viridis*) and Western Hog-nosed Snake (*Heterodon nasicus nasicus*).

An additional status report is under development for two non-vertebrate Species at Risk at Onefour: Endangered: Yucca Moth *Tegeticula yuccasella,* Threatened: Soapweed (Yucca) *Yucca glauca*. We have included brief accounts of these two species in Appendix 2.

2. STUDY AREA

Onefour is a substation of Agriculture and Agri-Food Canada, Lethbridge Research Centre, Lethbridge, Alberta, established in 1927. It encompasses 18,000 ha, between latitudes 49° 00' to 49° 11' N and longitudes 110° 20' and 110° 33' W, and with an average altitude of about 934m (Adams et al. 2005).

Located in the Dry Mixedgrass Subregion of the prairie ecozone about 145 km SE of Medicine Hat, the substation is bounded on the north and northeast by the Sage Creek Grazing Association, on the southeast by the Q Ranch owned by the Kusler family, on the west by the Lost River Ranch, and on the south by the International Boundary. Highway 502 runs east-west through the substation, and the Lost River is the major creek, running southeast through the southwestern corner of the area, to join the Milk River just south of the International Boundary.

Onefour falls within the Eastern Alberta Plains physiographic unit and is classified as an undulating till plain of predominantly loamy, moderately calcareous character (Clayton et al 1977). Surficial deposits are primarily of glacial origin. Onefour is dominated by Brown Chernozemic and Solonetzic soils (Adams et al 2005). Soils are mainly light loam. Elevations range from about 1000m along the northern boundary to 820m on the Milk River floodplain to the south. Topography is level to gently rolling with upland areas dissected by deeply-eroded coulees that are often dry for most of the year. Drainage is largely into sloughs, although the local system is the Lost-Milk River drainage that flows into the Missouri Watershed.

Climatically, the Dry Mixedgrass Subregion is the warmest and driest in Alberta with droughts occurring in summer and chinooks moderating winter temperatures. It has a typical continental climate with cold winters, warm summers and low precipitation. Because of warm summer temperatures and high average wind speed, the rate of evaporation is high throughout the summer months. The region is characterized by a mean daily temperature of 4.7° C, a growing season of May - September, and summer

mean temperature of about 16° C. The mean winter temperature is typically - 7° C. Total annual precipitation is usually around 353 mm, of which 66% falls as rain. Summer precipitation is the lowest of any Subregion in Alberta. Compared to other Subregions, the Dry Mixedgrass Subregion has high year-to-year precipitation variability. Spring is the wettest season with the peak occurring in June. The amount of snow cover is relatively low as is the number of days of continuous snow cover. There are more than 30 chinook days per year, with about 180 days with frost, 80 – 110 mm with snow which is melted frequently by Chinook winds before it can enter the soil, but with considerable variation among years (Adams et al 2005).

The name 'Mixedgrass' comes from the predominance of both short and mid-height grasses. The most widespread are the mid-grasses *Stipa* spp. (spear grass), *Agropyron smithii* (western wheat grass) and *Koeleria micrantha* (June grass) and the short grass *Bouteloua gracilis* (blue grama). The majority of Mixedgrass vegetation is a needle-and-thread grass (*S. comata*) – blue grama community, with western wheatgrass and northern wheatgrass (*A. dasystachyum*) also important in hummocky moraine areas (Pierce 1980, Adams et al. 2005).

Needle-and-thread grass dominates medium to coarse textured soils, with northern wheatgrass, blue grama, June grass, and important herbs and shrubs such as fringed sage (*Artemesia frigida*), silver sagebrush (*A. cana*), and sedge (*Carex filifolia*). On lacustrine clays, western wheatgrass dominates with June grass. Solonetzic soils are typically occupied by the western wheat grass - blue grama community, with June grass, cactus (*Opuntia polycantha*), sagebrush and saltsage atriplex (*Atriplex nuttallii*). Northern wheat grass and western porcupine grass (*S. curtiseta*) are characteristic of moister sites within the Subregion, and depressional areas support western wheatgrass, tufted hairgrass (*Deschampia caespitosas*), Nuttall's alkali grass (*Puccinellia nuttalliana*), foxtail barley (*Hordeum jubatum*) communities. Heavy grazing reduces the amount of needle-and-thread and northern and western wheat grasses, and blue grama, Sandberg's bluegrass (*Poa secunda*) and weedy species become prevalent (Pierce 1980, Adams et al. 2005).

The most widespread vegetation of sand dune areas is dominated by spear grasses, sand grass (*Calamovilfa longifolia*), June grass and a variety of low shrubs including silver sagebrush, silverberry (*Elaeagnus commutata*), western snowberry (*Symphoricarpos occidentalis*) and prickly rose (*Rosa acicularis*). Floodplains are dominated by western cottonwood (*Populus sargentii*), willows (*Salix* spp.), roses (*Rosa* spp.), chokecherry (*Prunus virginiana*), and amelanchier (*Amelanchier alnifolia*) (Pierce 1980).

Although much of the natural vegetation of the Dry Mixedgrass Subregion has been replaced by agricultural crops, extensive areas of native rangeland remain that are managed primarily for grazing by domestic livestock. At the Onefour station approximately 3800 ha have been converted to tame pasture species. About 14000 ha remains as native pasture.

3. METHODS

We conducted systematic point counts and random observations in 2002, 2003 and 2004 to detect SAR at Onefour. The details are outlined below. In 2004, staff surveyed for Burrowing Owls by vehicle, quad and on foot. In addition we undertook a literature search and requested records of SAR from the provincial database program (FWMIS 2005).

3.1 Survey Methods

The systematic survey used point counts primarily to locate Burrowing Owls (*Athene cunicularia*) but also to record all SAR and a few other species of interest. Point counts were conducted every 800 m, plus or minus 100 m to maximize visibility of the grassland, along trails and roads, all with minimal or no traffic. The following procedure was followed at each stop. First, there was an initial scan for owls prior to exiting the vehicle, followed by a three minute look-and-listen period, and followed by three minutes of Burrowing Owl playback. The search area was within a 400 m radius circle of the observation point. A CD player with a playback of a repeated male territorial call was played on maximum volume on the roof of the vehicle; it was determined that the playback sound carried beyond 800m in calm conditions. UTM locations were taken at each stop.

Point counts were initiated in calm weather with no precipitation. However, some surveys were completed in higher winds. In general, weather conditions were good during the surveys with winds at Beaufort 2 or lighter, temperatures between 10-25°C, and skies were clear. Surveys were conducted mainly in the mornings.

The survey covered existing trails within Onefour, and in 2002 involved off road by all-terrain vehicles. Points were not biased by known owl sites. All observers were familiar with Burrowing Owls in the wild, their low profile when hiding, and their calls. All observers participated in a training session in early May. Burrowing Owl locations were estimated or measured with a GPS. General observations were recorded at each stop about the terrain and habitat.

Either three minute period could be extended to five minutes for a total of up to ten minutes at the discretion of the observer, if burrows were common or if there were many ground squirrels or many owl-shaped cacti. The objective was to detect owls and other species of interest, thus the flexibility in time allowed the observer to adjust the search effort for the difficulty of the terrain and the number of observations to record. During the surveys, other species of special interest including Sprague's Pipit (*Anthus spragueii*), Loggerhead Shrike (*Lanius ludovicianus*), Long-billed Curlew (*Numenius americanus*), Ferruginous Hawk (*Buteo regalis*), Short-eared Owl (*Asio flammeus*) and Richardson's Ground Squirrel (*Spermophilus richarsonii*) were recorded.

Casual observations of all species at risk were also noted during each year at Onefour. A historical review was undertaken to locate other sightings of species-at-risk.

3.2 Data Analysis

Point counts were tabulated into Excel spreadsheets, and total number and percent occurrence of each species was determined. UTM for points at which SAR species were recorded are given in the Appendices. The nests of Burrowing Owls were located on point count surveys, by casual observations and by intensive searching of potentially high suitability areas; the records were tabulated and are included in the species accounts.

AGRASID (Agricultural Region of Alberta Soil Inventory Database) is a database describing the spatial distribution of soils and associated landscapes within the agricultural region of Alberta. Onefour was described in a Landscape Model which combines the following three attributes used to characterize landscapes:

1. **Surface Form**
2. **Slope Classes** (Agriculture Canada Expert Committee on Soil Survey 1987)
3. **Surface Form Modifier**

The complete listing and definition of the Landscape Models and Surface Form Modifiers used in AGRASID are provided in the following list. The surface form modifiers are used to describe unique features of a particular landscape model, but are relevant when assigning some interpretative ratings.

Modifier	Definition
I3h	inclined to steep, single slope landforms with high relief (ex. fans, aprons)
I3l	inclined to steep, single slope landforms with low relief (ex. fans, aprons)
I4h	inclined to steep, single slope landforms with >10% exposed bedrock with high relief
I4m	inclined to steep, single slope landforms with >10% exposed bedrock with moderate relief
R2l	Ridged (includes fluted terrain) with low relief
R2m	Ridged (includes fluted terrain) with moderate relief
U1h	undulating with high relief
U1l	undulating with low relief

The locations of point counts for each year (2002, 2003 and 2005) were overlaid onto an AGRASID map of Onefour, and the presence or absence of species at each point was determined.

According to the Plant Range Community Guide to Alberta, Onefour falls into the Wildhorse Plain ecodistrict of the Mixedgrass Natural Subregion (Fig. 2, in Adams et al. 2005). Ecodistricts are based on distinct physiographic and/or geologic patterns. They are distinguished by similar patterns of relief, geology, geomorphology and genesis of parent material. The Ecological Range Site of the Wildhorse Plain is characterized by "Blowouts", "Loamy", "Overflow" and "Thin Breaks". These terms refer to soil and landscape information (Appendix 9.1 *in* Adams et al. 2005). "Blowouts" have Solonetzic soils with an impervious hardpan layer in the subsoil caused by excess sodium, and the land surface frequently characterized by eroded pits. "Loamy" sites have

medium and moderately-fine textured soils and include loam, silt, and clay loams. "Overflow" are soils developed on fans and are areas subject to water spreading and sheetflow, and generally are on gentle inclines. "Thin Breaks" are areas with bedrock at or near the soil surface and can be gentle to steep landscapes. Each of these categories has a plant community associated with it; such communities are listed in Table 10 *in* Adams et al. (2005). Figure 1 shows the soil and landscape types for Onefour in polygons; as an example, GEHU13/U1h means that it is a "blowout" category with "gem" and " hemuruka" soils, in an undulating landscape, with a silver sagebrush/ northern wheatgrass-june grass-blue grama grass plant community. Each point was assigned a soil, landscape and plant community designation based on the polygon where it occurred.

4. RESULTS

4.1 Point Count Data

A total of 280 point counts were taken during the three years; 50 in 2002, 88 in 2003 and 142 in 2005. Counts in 2002 were conducted 23-24 July, in 2003 between June 1 and 3, and in 2005 between June 11 and 23. The whole of Onefour received coverage at some level during the three years, with the eastern and especially southeastern areas receiving most coverage, and the western third the least (Figures 2 – 4).

Land visibility: Because of the undulating terrain, not all land within the 400m radius was always visible to the observer. Land visibility of the 400 meter radius circle from each observation point ranged from 87% in 2003 to 94% in 2005. In all three years, most points had greater than 90% visibility. For example, in 2005, 71 out of 142 points had 100% visibility and a further 50 points had 90 – 95% visibility, accounting for 85% of all points.

Land classification: Percent coverage of native vegetation in the observation circle ranged from 57% in 2002 to 92% in 2003, with 2005 intermediate at 76%. Tame pasture accounted for most of the rest, with wetlands accounting for less than 1% of the terrain.

Vegetation Height: Data collected on vegetation height within the observation circle were influenced by several variables, such as spring precipitation, the presence of cattle, and timing of the surveys. Most points (90%) in 2002 and 2003 had vegetation taller than 20cm, and 62% of points in 2005 had vegetation taller than 20cm.

Large numbers of cattle were present on various pastures during the survey.

4.2 AGRASID Data

The distribution and location of point counts in relation to the landscape model of Onefour are shown in Figures 2 - 4 for each year 2002, 2003 and 2005.

Figure 1. Soil and landscape types at Onefour Agricultural Research Substation from AGRISID.

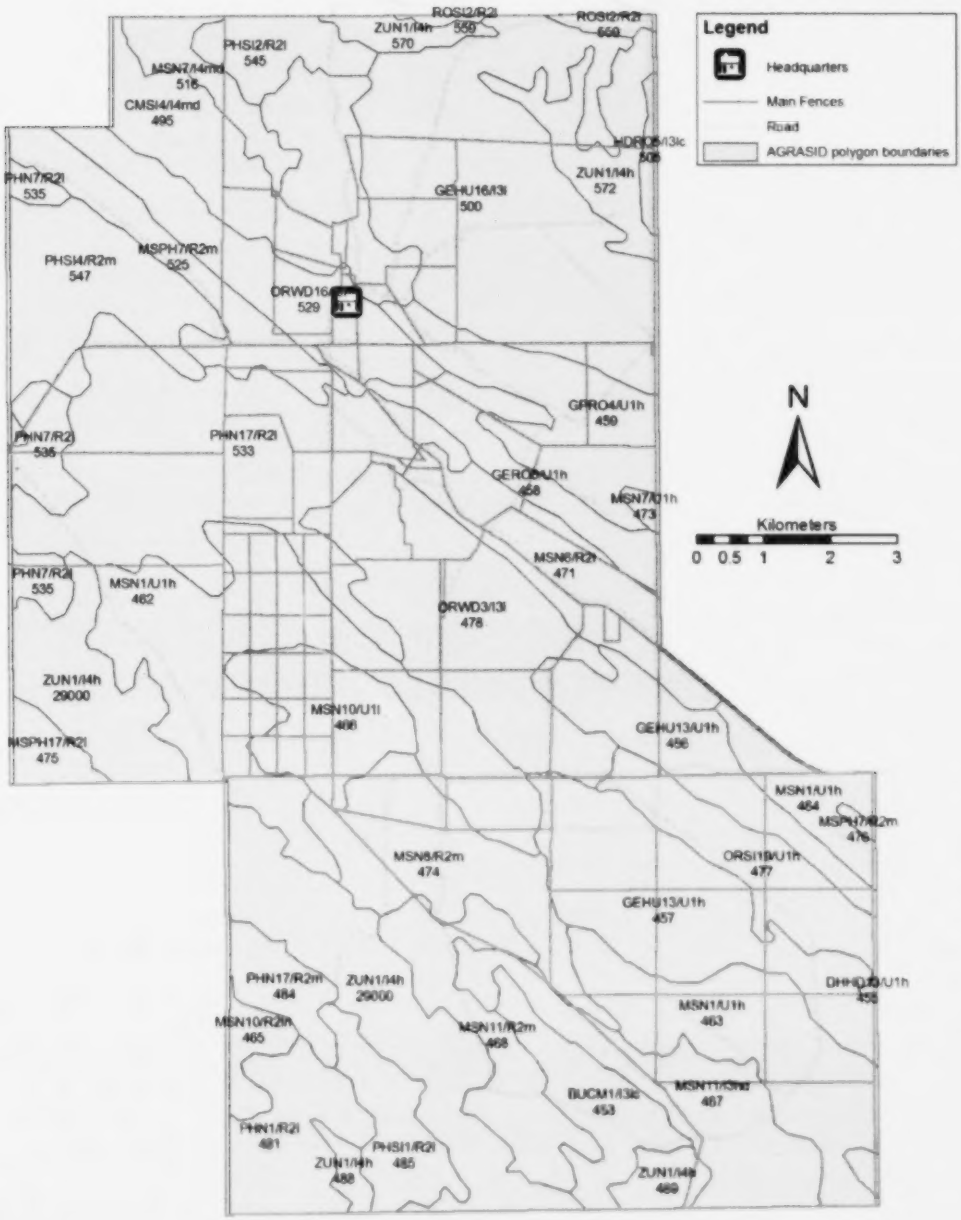


Figure 1. Soil and landscape types at Onefour Agricultural Research Substation from AGRISID.

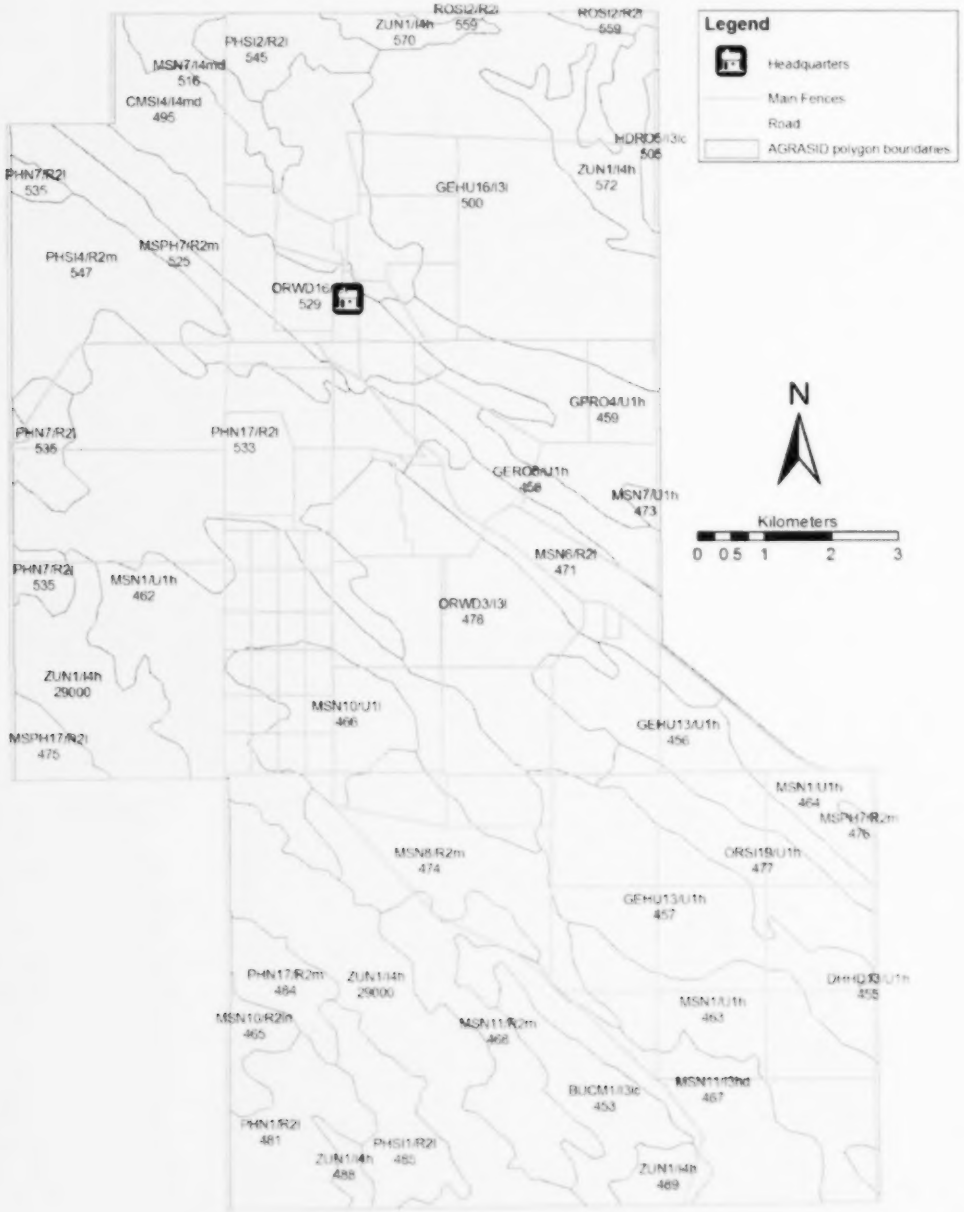


Figure 2. Distribution of Point Counts at Onefour in 2002 plotted on AGRISID landscape units.

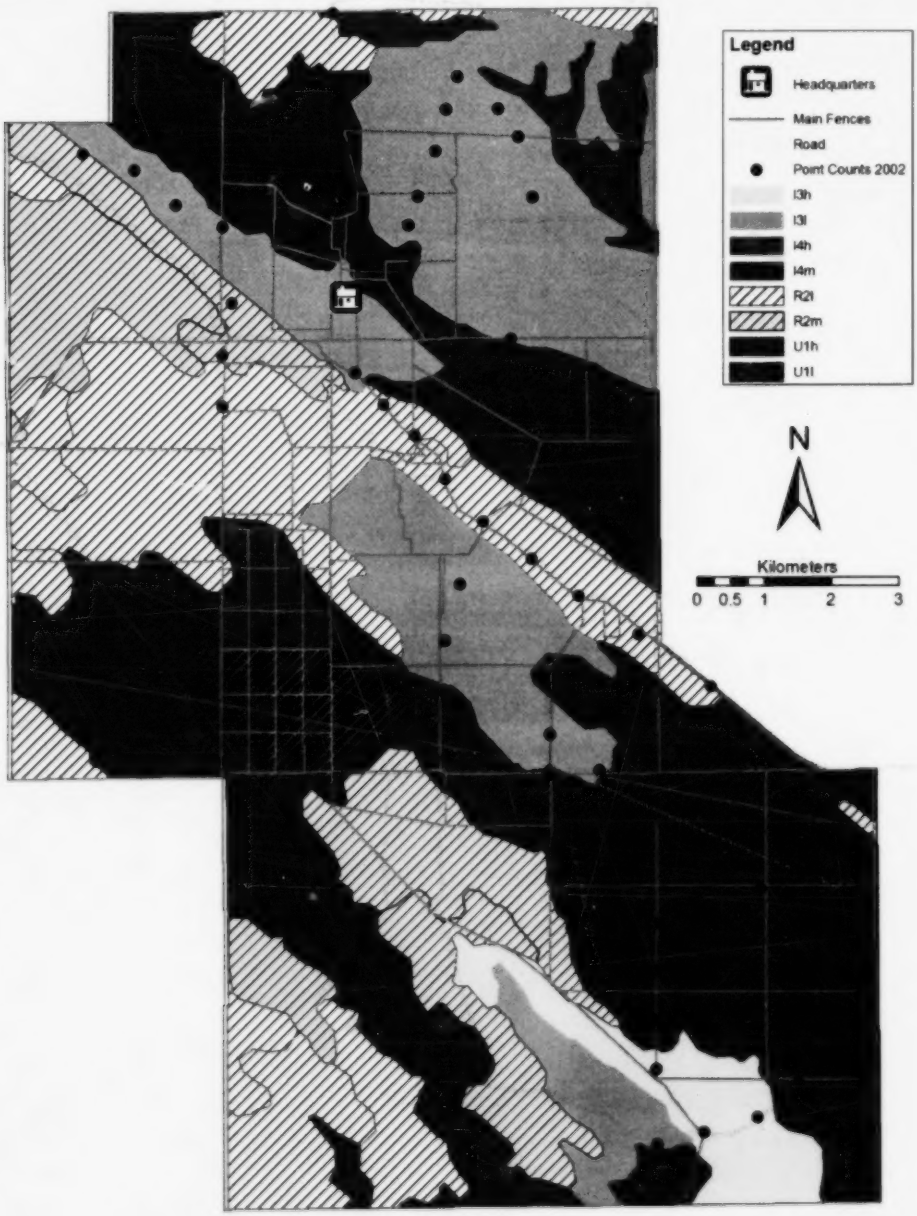


Figure 3. Distribution of Point Counts at Onefour in 2003 plotted on AGRISID landscape units.

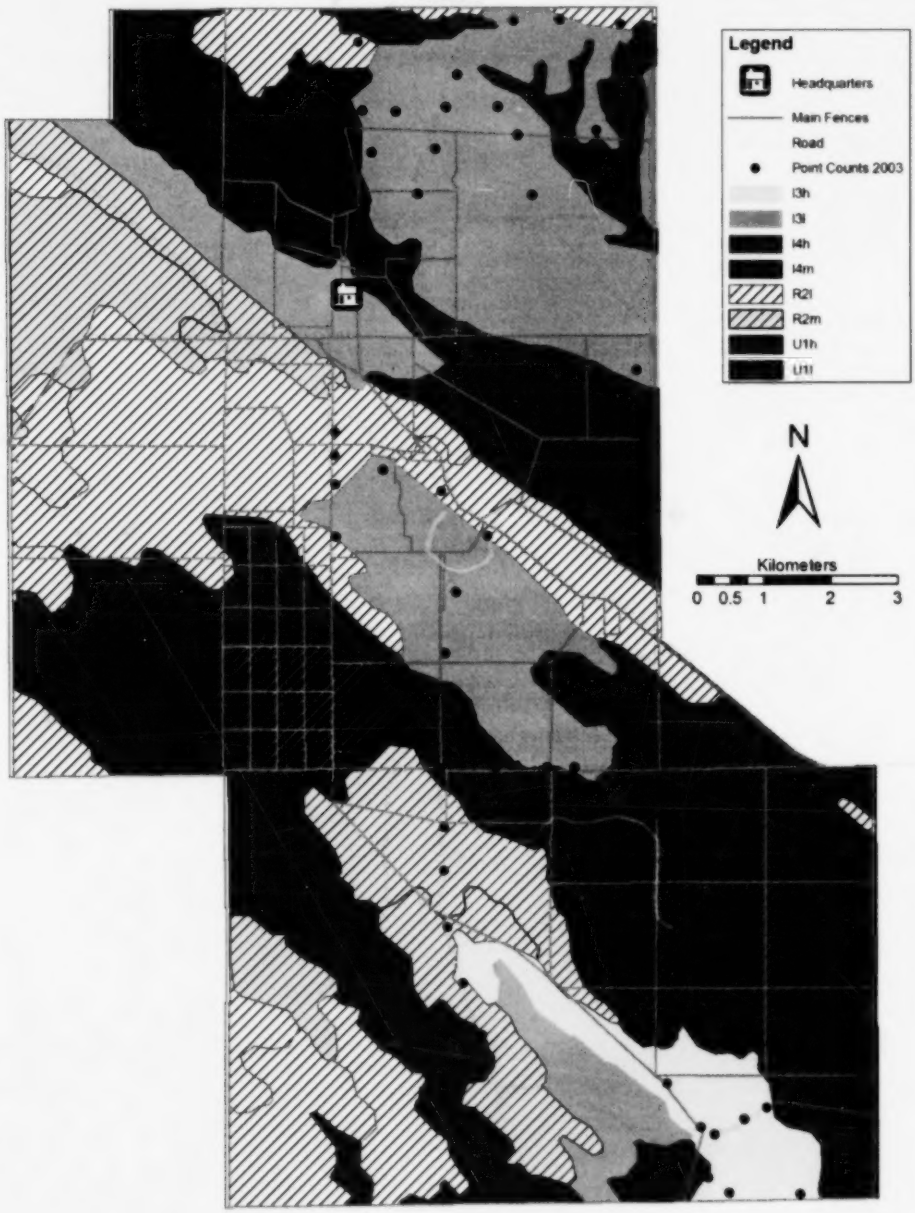
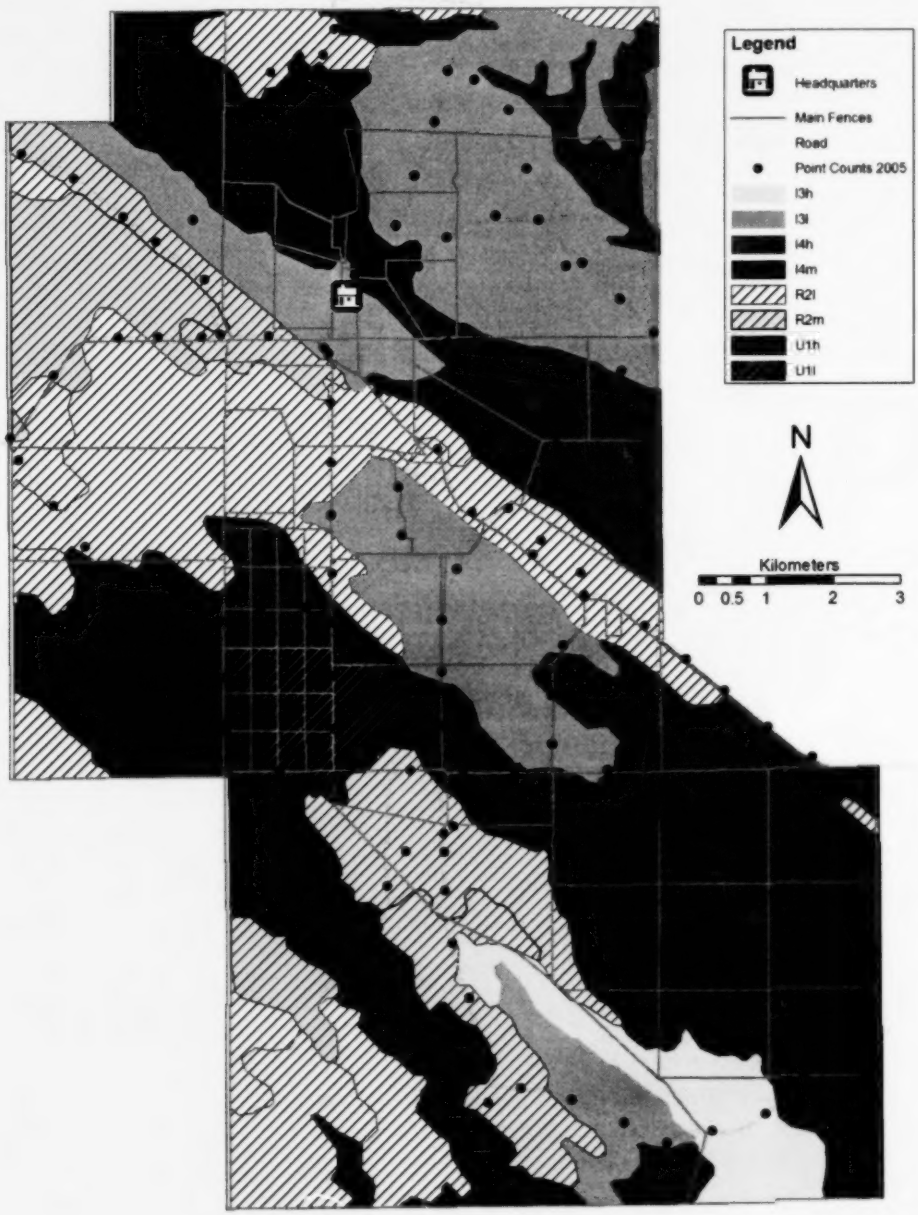


Figure 4. Distribution of Point Counts at Onefour in 2005 plotted on AGRISID landscape units.



5. SPECIES ACCOUNTS

5.1. Extirpated Species

5.1.1 Black-footed Ferret (*Mustela nigripes*)

The black-footed ferret was last recorded in Canada in 1937 (Laing and Holroyd 1989). The species was thought to be extinct until a small population was discovered in Wyoming in 1981. Since then ferrets have been successfully bred in captivity in the US and released into prairie dog colonies in the US and Mexico.

The historic range of ferrets extended to the north and west of the range of prairie dogs. Outside the range of prairie dogs, ferrets likely survived on Richardson's Ground Squirrels . This historic range does include Onefour station. A dead ferret was found near Etzicom west of Onefour in 1972 (Pinel 1973). This species is not likely to be found at Onefour in the foreseeable future, regardless of any successful reintroductions and subsequent range expansion.

5.2 Endangered Species

5.2.1 Swift Fox (*Vulpes velox*)

The swift fox was extirpated from Canada and northern Montana by the late 1930s. Since 1983, a reintroduction program has been underway to restore this species to Canada and the most recent releases were made in Grasslands National Park, Saskatchewan in 1997 (Moehrenschlager and Moehrenschlager 2004).

A Canadian swift fox census during the winter of 1996-1997 revealed that the reintroduced population was located within two regions: 1) approximately 192 foxes were estimated to span the Alberta/Saskatchewan border south of the Cypress Hills; and 2) approximately 89 foxes were thought to exist along the United States border in and around Grasslands National Park, Saskatchewan. Concurrent with the Canadian swift fox reintroduction program, mounting evidence suggested that Canadian fox releases had also established a small swift fox population in north-central Montana. However, a coordinated international effort has not been previously conducted to assess the extent and composition of the shared swift fox population in Canada and Montana. The focus of the 2000-2001 census was: 1) to estimate changes in the distribution and abundance of swift foxes within Canada since the 1996-1997 census; 2) to estimate the distribution and abundance of swift foxes in adjacent areas of Montana. Results showed that the known distribution of swift foxes in Canada and Montana has substantially increased through the results of this census. In particular, in the Alberta/Saskatchewan border area, swift foxes were found in 18 townships in 1996-1997 and during the 2000-2001 census they were found in 38 townships. As regards Onefour, swift foxes were found in Township 2, Range 4 but not in Township 1, Range 4 (Moehrenschlager and Moehrenschlager 2004).

According to Ian Walker, there has been a Swift Fox den east of the Onefour headquarters for the past few years (specific location not determined). It was not occupied in 2005, but sightings in 2005 of individual Swift Foxes in the general area including one in September indicate that an active den is nearby (I. Walker, pers. com.).

5.2.2 Greater Sage-Grouse (*Centrocercus urophasianus*)

Background

Distribution and Population

Sage Grouse are presently found in Alberta, Saskatchewan and eleven states of the western United States. Its current Canadian range covers 4000 km^2 in southeastern Alberta and about 4300 km^2 in southwestern Saskatchewan. Historically it was found in five more states and in British Columbia, and was more than 10 times more abundant in the Canadian Prairie provinces. It is thought that there may have been 10 million Sage Grouse in North America at the time of European exploration. By 1970 there were 1.5 million, and the population has continued to decrease (Aldridge 1998).

In Alberta, the Sage Grouse population was estimated at 3000-6000 birds in 1968; it was reduced to 400 by 1995. The number of known active lek sites used by Sage Grouse in Alberta in 1997 was eight, 51% lower than the average number used between 1968 and 1989. Surveys conducted in the spring of 2001 in the province show 108 males at 8 active leks in the province. The total population estimate for Alberta in 2001 was approximately 480 individuals. Overall, adult survival appears to be low. The survival of chicks from hatch through to the following spring also appears to be well below normal for Sage Grouse populations. Numbers suggest that the overall population of the species in the province has declined by about 80 % from levels observed in the late 1960s and early 1980s (Aldridge 1998). It has been suggested that 500, and possibly even 5000, individuals may be required to sustain the population (Anonymous 1997, Braun 1995). The Sage Grouse is therefore at risk of declining to nonviable population levels in Alberta (Aldridge 1998).

In Alberta, under the Alberta Wildlife Act and its regulations, the Sage Grouse is classified as an "upland game bird". However, concerns over the decline in population numbers led to a decision, in late 1995, to close the hunting season on Sage Grouse in Alberta beginning in 1996. Sage Grouse are now protected by law against the capture, killing, or harming of individuals or their nests. In a 1991 review of the status of Alberta wildlife, Sage Grouse in Alberta were given a "Yellow" listing, which means that they were considered a species of concern due to their naturally low populations, and their limited habitat and distribution in the province (Alberta Fish and Wildlife 1991). Five years later, Sage Grouse were included on the "Blue List" of species that may be at risk in the province. This designation was assigned based on the species' limited distribution in Alberta, specific habitat requirements and declining population numbers (Alberta Wildlife Management Division 1996).

Habitat
Sage Grouse are found where sagebrush grows, especially in Big Sagebrush (*A. tridentata*) habitat. In Canada this corresponds to the dry mixed grassland ecoregion, where it is warm and dry. In Alberta, areas with native grass and Silver Sagebrush are preferred for leks (Jones et al. 2005). Sage Grouse nest in sagebrush habitat most successfully where both lateral and vertical cover is present, and near running water.

Threats
The conversion of millions of hectares of Sage Grouse habitat to agricultural land has contributed greatly to the decline of the species. Heavy grazing, especially over the long term, is detrimental to the species. Oil and gas development, especially near leks, puts added pressure on the species. The grouse are also prone to injury and death due to collisions with fences, power poles and vehicles. They avoid areas within 800 m of power lines because poles are used as perches by raptors. Golden eagles are the most important predators of grouse at leks. Other predators are bobcats, weasels, domestic cats and coyotes. In Alberta, increasing coyote populations in the early 1990s may have been a factor in Sage Grouse decline. Since very few males of any population actually breed, any fewer than 500 birds is not considered a viable population size (Aldridge 1998).

Onefour Sightings

No leks are known to be currently active at Onefour (Fig. 1 *in* Aldridge 1998). The pasture manager at Onefour, Ian Walker, reported seeing small flocks of Sage Grouse during the winter in the southern part of Onefour close to the International boundary. Wershler and Wallis (1986) recorded them on a 'few' occasions along the Lost River and suspected that they may nest in Onefour. Only one Sage Grouse was sighted on Onefour by all CWS research team members, despite extensive Burrowing Owl research there from 2002 through 2005.

On June 11 2005, a female Sage Grouse was flushed from the side of a gravel road west of the administration building by R. Knapton at UTM 536009, 5441655. The bird alighted in sage brush, walked slowly through the vegetation clucking constantly, and then proceeded to walk over a rise and out of sight. She flushed when approached, clucking loudly, landed about 50m away and hid. The behaviour indicated the probable presence of a brood hiding in sagebrush alongside the road. The sighting and inference of a brood indicate that Sage Grouse may use Onefour more than is currently realized and a lek is likely not far away.

5.2.3 Mountain Plover (*Charadrius montanus*)

Background

Distribution and Population
Mountain Plovers breed in the western Great Plains, from southern Canada to Texas. The winter range is primarily in California although the species also winters in northern Mexico, southern Arizona and southern Texas. In Canada, the Mountain Plover is an

irregular breeder in southeastern Alberta and southwestern Saskatchewan. The North American range has contracted from earlier times, especially along its eastern edge. In fact, the Breeding Bird Survey revealed that the decline in this species from the 1960s to the early 1990s was larger than that of any other endemic grassland bird (Sauer et al. 2005). Scientific survey data are lacking, but during the last two decades there have probably been fewer than 50 adult Mountain Plovers in Canada. In Alberta, the maximum number of adults counted in any one year was 11 adults in 1981.

Habitat

Mountain Plovers inhabit flat areas with short vegetation (usually less than 10 centimeters high) and bare ground. Grazing mammals and Black-tailed Prairie Dogs (*Cynomys ludovicianus*) play important roles in keeping the habitat suitable for the species. Mountain Plovers prefer heavily grazed grassland, but areas with light grazing that have been burned recently can provide suitable habitat for the birds. Cultivated fields are also used for nesting in the southern part of the North American range. In Canada, the bird has usually nested in grazed, or recently burned, areas of native mixed grassland. As a result of various factors, both historical and more recent, Mountain Plover habitat has become both localized and restricted in size (Wershler 2000).

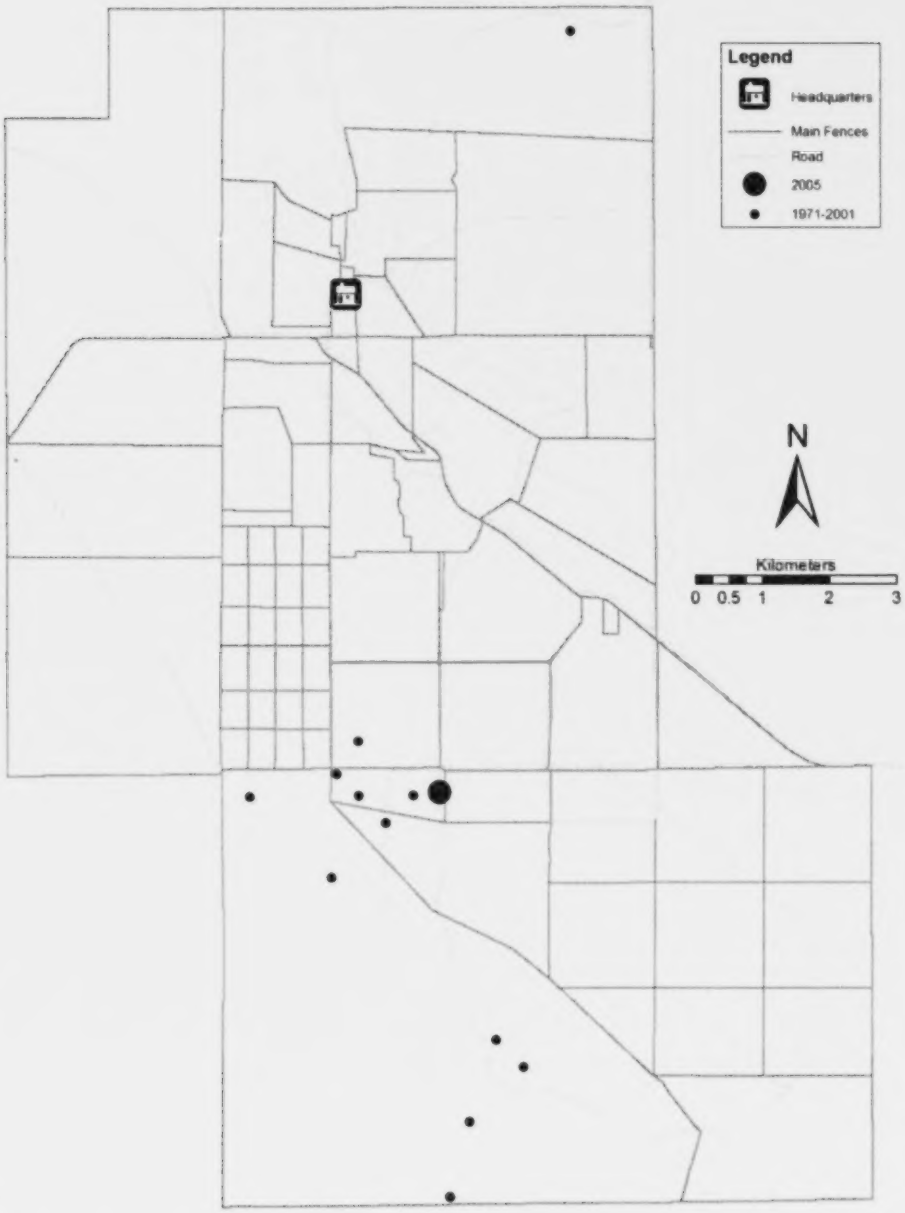
Threats

The decline in the continental population has been attributed to the conversion of native grassland to cropland, agricultural practices, management of domestic livestock, decline of native herbivores, and possibly pesticides. Suitable breeding habitat is restricted by those range management practices which discourage heavily grazed grassland. The resulting small, isolated breeding populations therefore become vulnerable to natural events such as weather extremes and predation (Wershler 2000). In Canada, Mountain Plovers are at the extreme northern edge of the range and any plovers are possibly spillovers from the US population.

Onefour sightings

Mountain Plovers were first observed at Onefour in 1971 (Figure 5, Appendix 3). They occurred during several years in the 1980s at Onefour, and then were essentially absent during the 1990s. Ian Walker, the pasture manager, reported a bird in 2001, an adult at the end of April (*in* Wershler and Wallis 2001). After a gap of four years, adults and a nest were located in 2005. At 1830 h on June 22, Geoff Holroyd and Helen Trefry located a single adult Mountain Plover at a nest with 3 eggs (UTM 5433596 540064). The bird was first observed about 75 m away; it approached the truck and went to its nest about 15 m from the vehicle. The nesting area was a heavily spring-grazed calving field with many patches of bare ground interspersed among the grass vegetation. No cattle were present at the time, but cow manure pieces were prevalent throughout the field and in the immediate vicinity of the nest. On June 24, R. Knapton observed three Mountain Plovers in the same general area, one of which was the incubating bird. A check of the nest and the area on July 5 revealed the nest to be empty. There was no eggshells present and the nest appeared intact, an indication that the eggs might have successfully hatched. No birds were seen.

Figure 5. Location of Mountain Plover sightings at Onefour, 1971-2005.



5.2.4 Piping Plover (*Charadrius melodus*)

Background

Distribution and Population
The *circumcinctus* subspecies of the Piping Plover breeds on the American shores of the Great Lakes (Michigan), at Lake of the Woods in Ontario, and throughout the Great Plains from the southern Canadian prairies to Nebraska. It winters along the Atlantic coast, from South Carolina to Florida, and along the coast of the Gulf of Mexico. In Canada, this subspecies breeds in central Alberta, southern Saskatchewan, southern Manitoba, northwestern Ontario (Lake of the Woods), and in south-west Ontario. The numbers of Piping Plovers have been decreasing in the northern Great Plains, increasing in Great Lakes, and increasing along Atlantic coast (Haig et al. 2005). The last two increases are believed to be due to management efforts. The prairie region had 1687 adults in 1996 but only 972 in 2001 (Amirault 2005). Piping Plovers often nest near the back vegetation line on exposed sand and gravel beaches and alkali mudflats. On the prairies, nesting occurs on gravel shores of shallow, saline lakes, river sand bars, and on sandy shores of larger prairie lakes and rivers. Seeps also provide important foraging habitat on the Prairies (Prescott 1997).

Onefour sightings

None of the wetlands in Onefour are suitable for Piping Plovers as nesting sites. The species may occur on migration. The closest documented nesting records are at Reesor Lake (Twp 8, Range 1). Thus we conclude that Onefour is not a significant habitat for Piping Plovers at any time of year.

5.2.5 Burrowing Owl (*Athene cunicularia*)

Background

Distribution and Population
Burrowing Owls occur in western North America in open unforested country from southern Canada to Mexico, west of the Mississippi River. The Canadian population occurs mostly in a band south of a line from Regina, Saskatchewan, to Hanna and to Lethbridge, Alberta, and infrequently in B.C.'s southern interior. Historically, the species occurred east to Winnipeg, west to Calgary, and north to Dauphin, Prince Albert and Wetaskawin. The winter range is the southern United States and Mexico.

The Canadian population is limited by the extent of grasslands. Over 75% of the prairies have been cultivated and much of the remaining grasslands have been altered by other human activities (Hjertaas et al. 1995). The Canadian population fell to an estimated 1685 to 1010 pairs in 1995 (Wellicome 1997). In the 1990s landowners reported a decline of 22% per year. There are now fewer than 1000 pairs in the Canadian prairies, and the species is absent or rare in regions where it was once common; as an example, the Burrowing Owl was effectively extirpated from Manitoba and BC (Holroyd et al 2001).

In Alberta, the Burrowing Owl was classified as an "endangered animal" under the Alberta Wildlife Act in 1987. The species was also included on Alberta's "Red List" in 1991 (Alberta Fish and Wildlife 1991), indicating its provincial population was in danger of declining to the point of becoming nonviable. The reasons given for this listing were the dramatic declines in the provincial and national populations, continued cultivation of nest sites, loss of ground squirrels, and pesticide use. For these same reasons, the Burrowing Owl was again categorized as a "Red List" species in the 1996 review of the status of Alberta wildlife (Alberta Wildlife Management Division 1996). In 1997 Alberta divided the endangered category into Endangered and Threatened and the Burrowing Owl was classified as Threatened where it currently remains (Alberta Sustainable Resource Development and Alberta Conservation Association, 2005), although it was recommended for up-listing to endangered in 2005.

Habitat

Burrowing Owls require treeless plains largely free of visual obstructions, such as grasslands grazed by livestock. The species uses burrows abandoned by ground-dwelling mammals (e.g., American Badger (*Taxidea taxus*), ground squirrels and prairie dogs) for nesting, roosting and caching food. Short or sparse vegetation and permanent cover are preferred around the burrows. Grasslands with thicker vegetation support prey items such as small mammals and insects. Thus the owls need a mosaic of grass densities to breed successfully. The species is sometimes found on roadsides and crop lands and in urban areas where mowing keeps expanses of grass short (Sissons 2003).

Threats

The availability of suitable burrows, or some sort of ground hole, is essential to Burrowing Owl habitation As well as serving as nesting sites, burrows provide shelter from extreme weather and predators. Cultivation of pastures, extermination of ground squirrels and badgers, and other agriculture techniques have combined to reduce the number of suitable burrows. The use of chemical pesticides to control grasshoppers and other insects has reduced an important food supply. When shortage of food forces the birds to forage far from their nesting sites, they become more susceptible to predation. Other factors that could have contributed to the decline of this species include inclement weather, illegal shooting, and collisions with motor vehicles. During migration they may have difficulty finding burrows since 99% of prairie dog colonies have been destroyed in the Great Plains. In winter, most of their habitat is cultivated, and burrows may be in short supply. The combined seasonal threats are all thought to have contributed to the decline of this species, leading to efforts to examine the conservation of the species on a continent-wide scale (Holroyd et al. 2001).

Onefour Sightings

Point Count Survey Results

In 2002, a single owl was found during the point counts, an occurrence rate of 2%. In 2003, three single owls were located during point counts (3.4%); subsequent visits proved each site to hold pairs. In 2005, 18 owls were located at 14 points (9.9%). Thus the proportion of point counts were owls were detected increased over the three years of

surveys (Figure 6). For all three years combined, Burrowing Owls occurred at a rate of about one owl per 16 stops, or about 6 owls per 100 stops. The increase in occurrence rate of Burrowing Owls from 2002 to 2005 reflects an increase in the number of owls nesting in the substation.

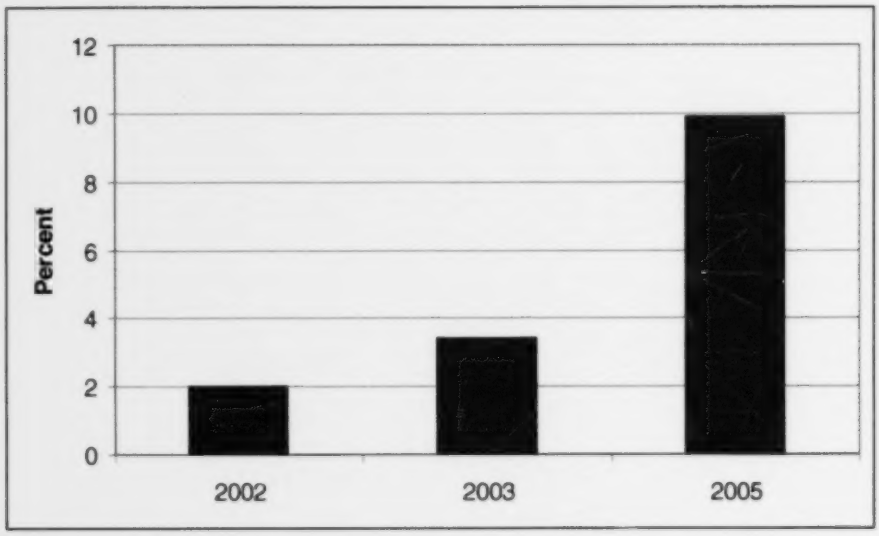


Figure 6. Percent of point counts where Burrowing Owls were detected at Onefour in three years of surveys.

Burrowing Owl nest records for 2002 - 2005

Additional Burrowing Owl nests were located at Onefour each year, either by ourselves or reported to us by station staff and other researchers and are listed in Appendix 4 with UTM co-ordinates. In 2002, four nests were located (Figure 7). During the point count surveys, the raptor-eaten remains of the female were found and a nest visit that evening confirmed the male was alone with 3 young. The remains of a fourth young, also eaten by a raptor, were also found. Of the other three nests, two were successful and one failed early in the season, apparently not a result of flooding from the heavy spring rains.

In 2003, ten nests were located, including three nests re-used from 2002 (Figure 8). Each of the nests successfully produced young. In 2004, 14 nests were located, including eight nests re-used from 2003 (Figure 9). Only one of the 14 nests was unsuccessful in producing young. In 2005, 28 nests were located (including one single bird), with 11 nests or roosts re-used from 2004 (Figure 10). This year only 9 nests produced young, owing to several variables including predation by one or two badgers. Fifteen of the pairs nested in a colony in a 13 km^2 area that had been surveyed in previous years and several of the owls utilized burrows that had been known as roost burrows in previous years. Fourteen of the 15 nests were depredated by badgers.

Figure 7. Location of Burrowing Owl nests in relation to AGRISID landscape units at Onefour in 2002.

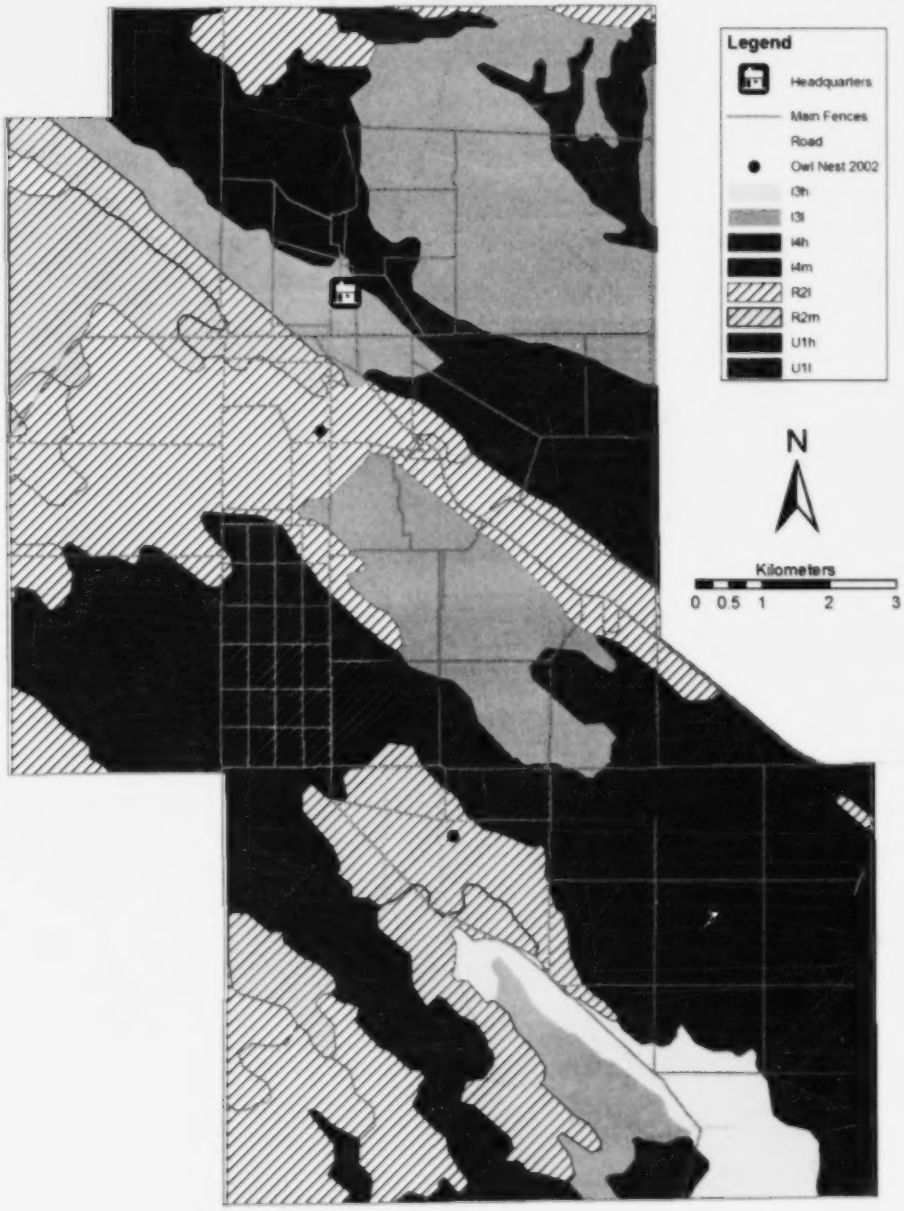


Figure 8. Location of Burrowing Owl nests in relation to AGRISID landscape units at Onefour in 2003.

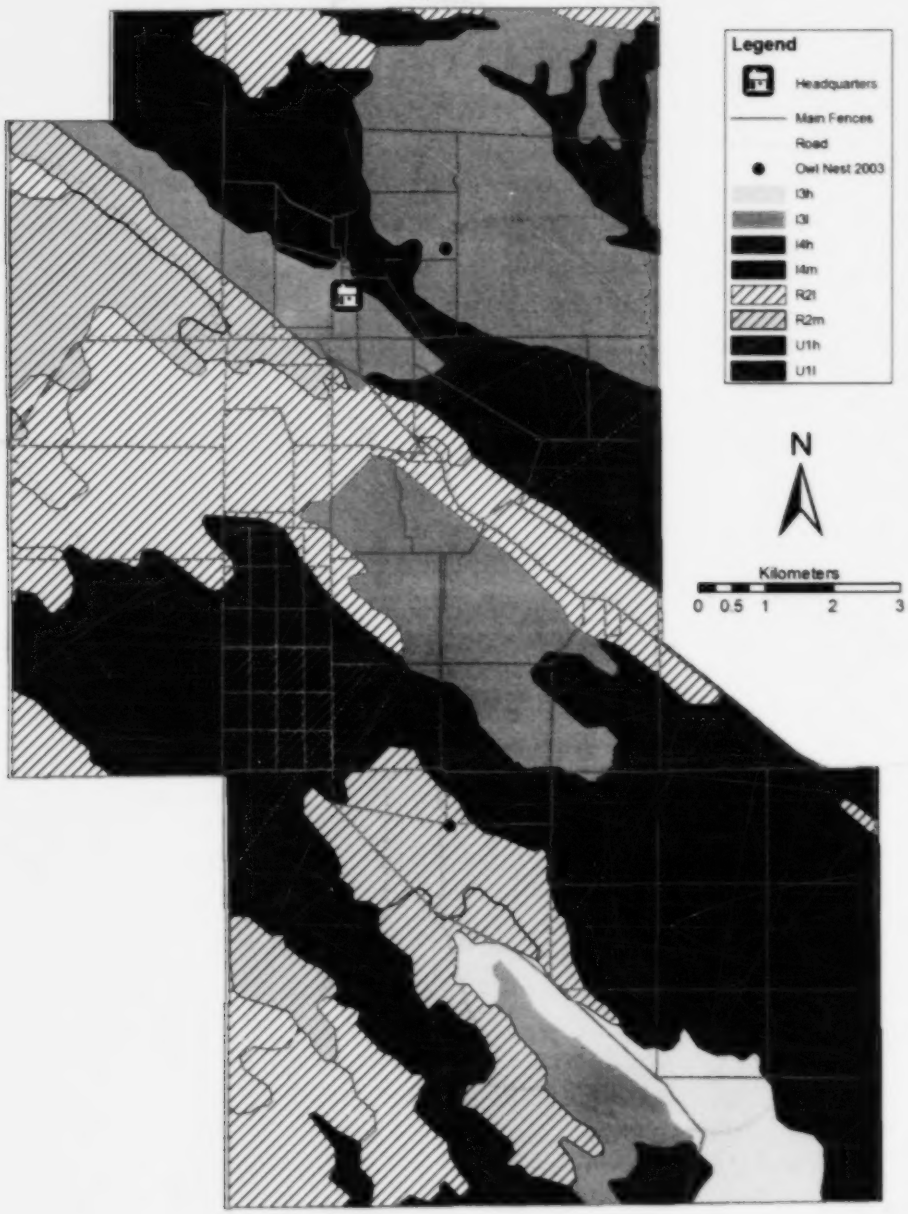


Figure 9. Location of Burrowing Owl nests in relation to AGRISID landscape units at Onefour in 2004.

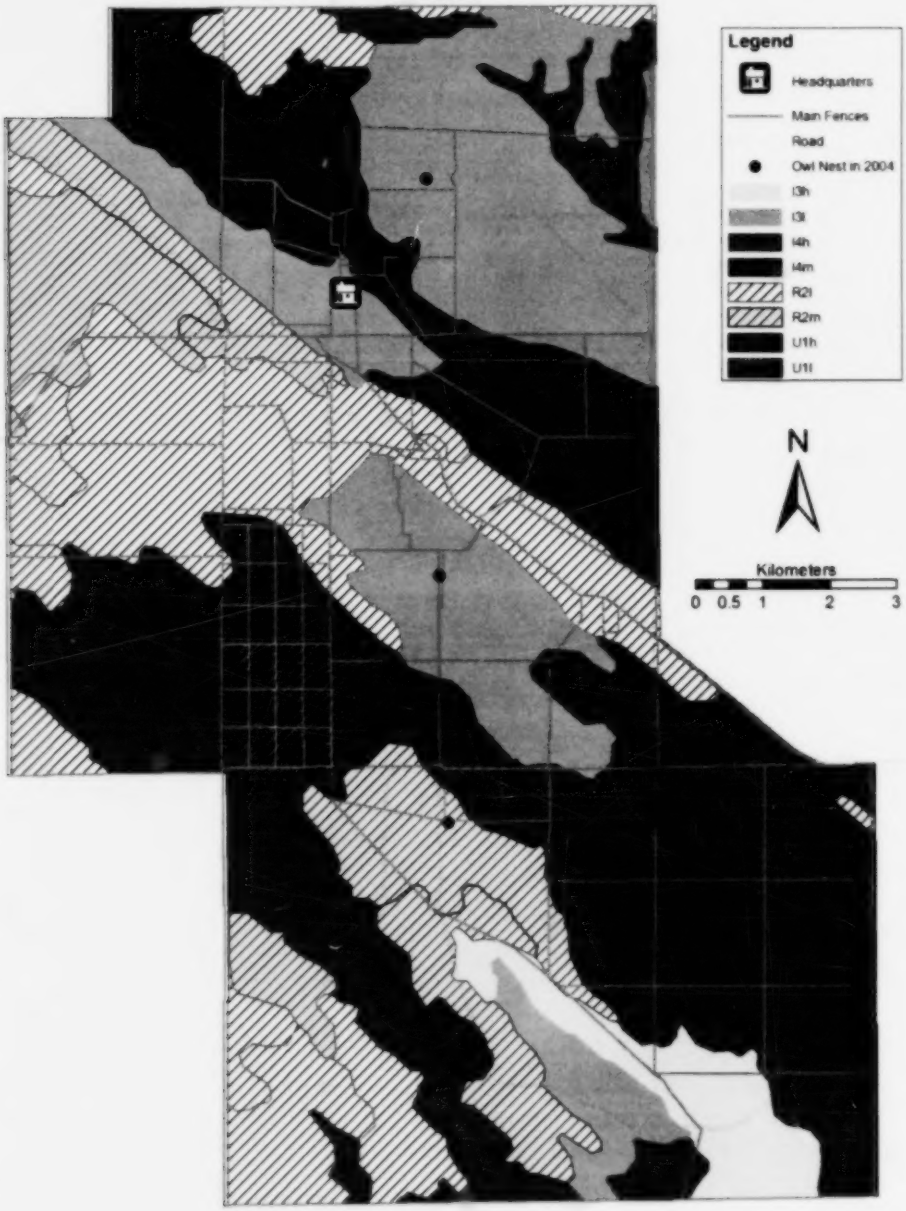
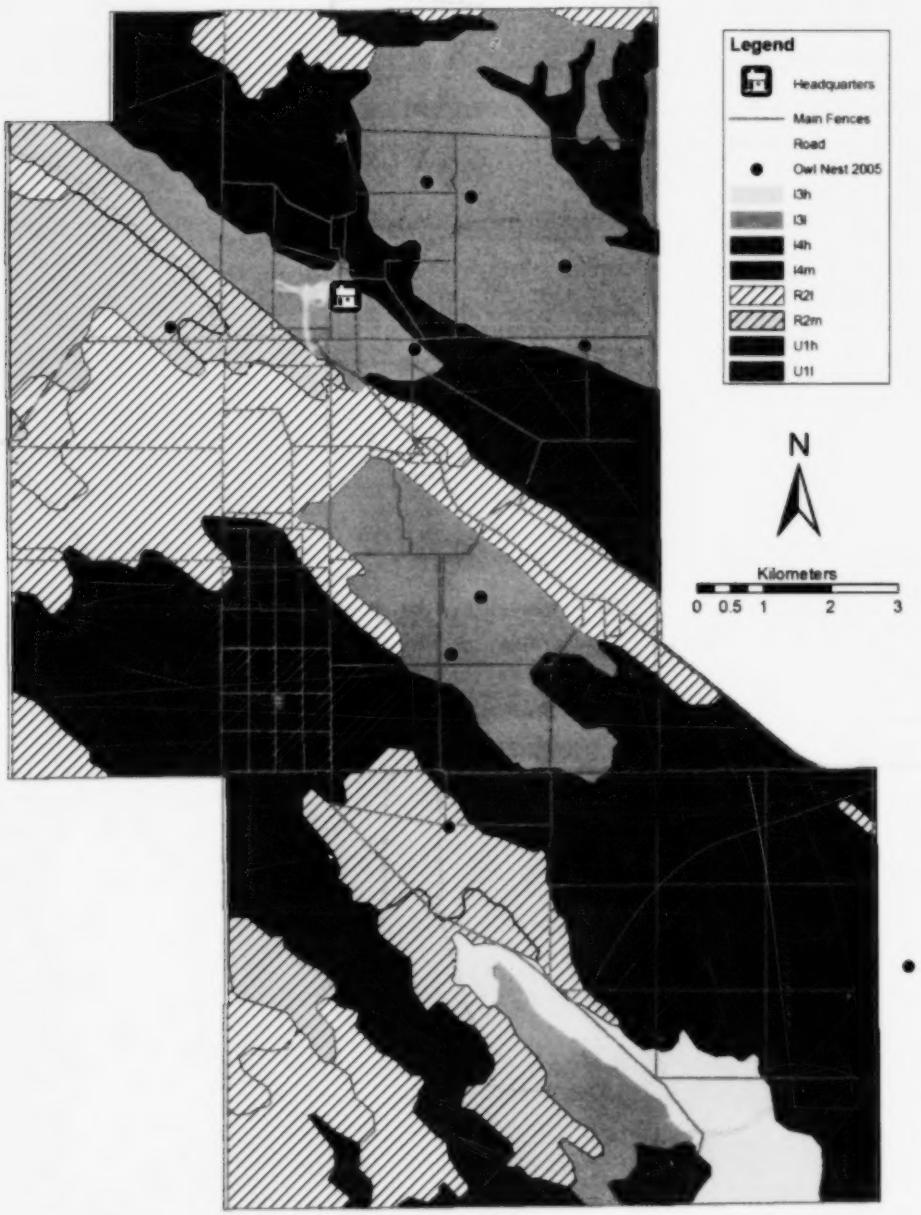


Figure 10. Location of Burrowing Owl nests in relation to AGRISID landscape units at Onefour in 2005.



Although the number of owl nests is not the result of constant effort, the increase from 2002 to 2005 is most certainly an increase in population (Figure 11).

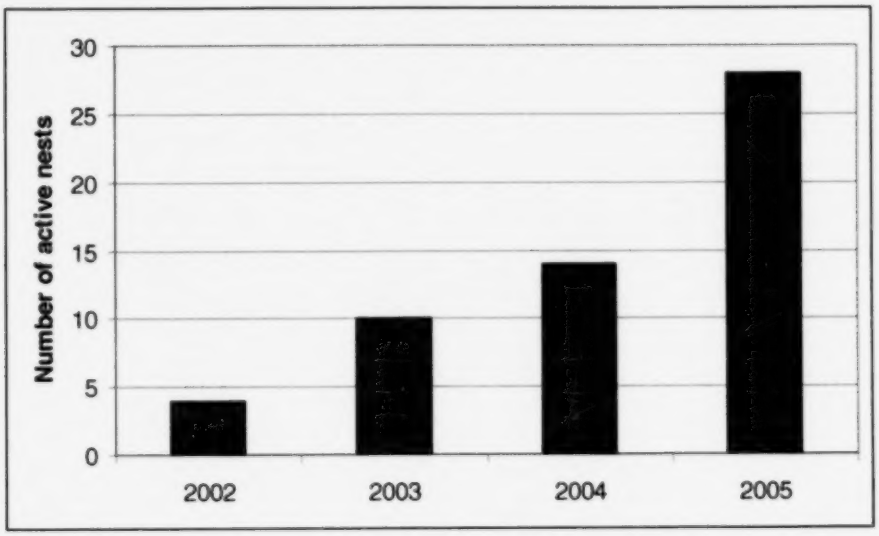


Figure 11. The number of active Burrowing Owl nests found at Onefour between 2002 and 2005

AGRASID Analysis

Over the 4 years, 57 burrows have been used as nests by burrowing owls. The distribution according to landform of the 57 locations for the nest burrows indicates clearly that the preferred landform is undulating with high relief (Maps/Figures 7 – 10). Thirty-seven nest burrows occurred in this landscape type. In contrast, only 6 sites occurred in ridged landscapes regardless of relief, and the remaining points were in inclined landscapes with low relief.

The majority of burrows (45) were located in silver sagebrush/Northern wheat grass-June grass-blue grama grass or silver sage – western wheat grass plant communities and fell into the "blowout"/"overflow" range site classifications.

5.2.6 Sage Thrasher (*Oreoscoptes montanus*)

Background

Distribution and Population

Sage Thrashers breed from extreme southern British Columbia, southward through the western United States to northern Arizona and New Mexico. The species also breeds, at least occasionally, in southeastern Alberta and southern Saskatchewan. The winter distribution extends from the southwestern states to central Mexico (Blouin 2004).

In North America, populations of the Sage Thrasher appear to be stable in areas where it has suitable habitat. In areas with extensive loss of sagebrush, Sage Thrasher numbers have greatly declined and some local populations have been eliminated. The breeding population in Canada varies among years and some sites are only occasionally used. The population trend generally appears to be declining. At one time , the British Columbia population may have reached 30 or more pairs in spring, whereas in 2000, the estimated population for this species was 6 to 30 individuals. The populations in Alberta and Saskatchewan have been too small to assess population trends (Blouin 2004).

Habitat

Sage Thrashers are almost entirely dependent on sagebrush habitat during the breeding season. Occasionally, the species has been seen in other shrub-steppe areas such as greasewood and antelope brush. Shrub size is very important for nesting, with the birds requiring sagebrush approximately one meter in height. In general, areas with suitable sage thrasher habitat in Canada have been slowly decreasing over the last 50 years. All threats relate to habitat quality and quantity. Overgrazing is less of a problem now than it was in the past, but in some cases it continues to affect private ranchlands (Blouin 2004).

Onefour sightings

There are no confirmed sightings of Sage Thrashers for Onefour, although suitable sagebrush habitats occur in scattered parts of the area. In Alberta, breeding has been reported irregularly south of Medicine Hat, and southeast and east of Manyberries since the mid 1980s (Al Smith, pers.comm.). Such sites are close to Onefour, and it seems reasonable to assume that the species occurs as a vagrant from time to time. The species has occurred as a vagrant in sagebrush along the border with Saskatchewan (e.g., May 2005, R.Knapton, *pers. obs.*).

5.2 Threatened Species

5.3.1 Peregrine Falcon (*Falco peregrinus anatum*)

Background

Distribution and Population
The Peregrine Falcon *anatum* subspecies breeds south of the treeline in Alaska and Canada, throughout most of the U.S.A., and from central to southern Mexico. The northern birds winter from Mexico south to southern South America. This subspecies was extirpated from most of eastern Canada, southern Alberta, Manitoba and the interior of British Columbia. Precipitous declines in peregrine populations in North America were associated with the widespread, intensive use of persistent organochlorine compounds, particularly the pesticide DDT. Levels of organochlorine contamination have declined substantially since restrictions were put in place in 1970.

In 2000, an estimated 500 pairs of Peregrine Falcon *anatum* subspecies nested in Canada. Releases of captive-bred peregrines from 1974 to 1996 were important in population recovery of the subspecies.

In Alberta, the Peregrine Falcon was unofficially considered to be an "endangered" species by *A Policy for the Management of Threatened Wildlife in Alberta* in 1985. Official recognition of "endangered" status under the Alberta Wildlife Act was made in 1987. In 1991, a review of the status of Alberta wildlife placed the *anatum* subspecies on the "Red List" of wildlife species which may be at, or declining to, nonviable levels in the province (Alberta Fish and Wildlife 1991). This status was assigned based on the small population size (less than 10 pairs), concern over pesticide residues, and the need for ongoing management to return populations to historical levels in the province. The "Red List" status was maintained in a similar review five years later (Rowell and Stepnisky 1997), when less than 50 breeding pairs were known to occur in the province.

Habitat
The habitat requirements of the Peregrine Falcon can be divided into three components (Johnstone 1999).:

1) the nest site: nests are usually scrapes made on cliff ledges on steep cliffs, and artificial cliffs such as quarries and buildings usually near wetlands;

2) the nesting territory: the area defended around the nest prevents other pairs from nesting within 1 km or more, ensuring adequate food for all nesting pairs and their young; the density of nests tends to be related to food availability;

3) the home range: the extended, non-defended area in which the peregrines hunt for additional food and which can extend to 27 km from the nest; peregrines prefer open habitats such as wetlands, tundra, savanna, sea coasts and mountain meadows, but will also hunt over open forest

Threats
The major cause of decline of Peregrine Falcon populations was the presence of agricultural pesticides in the environment, especially the organochlorine compound DDT. These compounds caused egg-shell thinning, egg breakage, reduced hatching success, reduced brood-size and reduced breeding success. Since Peregrine Falcons are at the top of the food chain, their tissues accumulate a great deal of these substances. Organochlorine contamination is no longer a major limiting factor for peregrines. Current threats include the small population size and the diminishing quality of habitat. Locally, peregrines may be affected by destruction of breeding sites and breeding areas, or by human intrusion near nest sites.

Onefour sightings

Despite intensive field research at Onefour, there have not been any sightings of Peregrines. The species ranges widely over the grassland ecosystems and possibly follows river valleys such as the Milk River during migration; no field work was conducted during these months. The presence of Prairie Falcons nesting in the Lost River valley indicates the presence of suitable cliffs, but the area has limited wetlands, a possible limiting factor. No Peregrines currently nest in southern Alberta south of Calgary (G. Court pers. comm.).

5.3.2 Loggerhead Shrike (*Lanius ludovicianus excubitorides*)

Background

Distribution and Population
In Canada, the Loggerhead Shrike, *excubitorides* subspecies, breeds in north-central, central and southern Alberta, central and southern Saskatchewan, and southern Manitoba. This subspecies is also a visitor to southern British Columbia. It winters in the southern United States. This subspecies seems to have been declining since the turn of the century; the greatest declines have occurred in the last 25 or more years (Prescott and Bjorge 1999).

In 1996, several thousand pairs were estimated in Saskatchewan, and 2500 pairs in Alberta. In 1997, there were an estimated 300 - 500 pairs of Loggerhead Shrikes in Manitoba. The most recent estimate available in 2001 counted 7000 pairs of shrikes in Saskatchewan, 2500 pairs in Alberta, and 500 pairs in Manitoba. The Eastern Prairie population, in Manitoba and eastern Saskatchewan, is declining. The Western Prairie population in central Saskatchewan and Alberta appears to be stable (Prescott and Bjorge 1999).

In Alberta, the Loggerhead Shrike was classified as a 'Red List' species in 1991 (Alberta Fish and Wildlife 1991), based on the belief that there were probably fewer than 500 breeding pairs in the province, and that populations were likely declining. In a more recent review of the status of Alberta wildlife (Alberta Wildlife Management Division 1996), the species was placed on the 'Yellow A List' of species that are not currently at

risk, but for which there is concern about long-term decline in numbers. This change in designation was made because the provincial population was larger than previously thought (probably closer to 2500 pairs). The species is ranked as 'S3' by the Alberta Natural Heritage Information Centre, because of its restricted and local distribution in the province (Alberta Natural Heritage Information Centre 1999a, b).

Although a firm estimate of the number of Loggerhead Shrikes breeding in Alberta has not been attained, it is apparent that the provincial population has declined in recent years. These trends are best quantified by Breeding Bird Survey data collected in Alberta, and elsewhere in North America, since 1966. BBS data show that between 1966 and 2003, populations in Alberta declined at a non-significant rate of 3.4% per year (Sauer et al. 2005). However, populations declined significantly during the first half of this period (10%/year from 1966-1980), whereas the population showed an average annual (non-significant) increase of 8%/year since that time (Sauer et al. 2005).

BBS routes have historically been concentrated in the southern part of Alberta (core range of the Loggerhead Shrike in the province). Therefore, provincial trends calculated from BBS data probably underestimate the true decline in numbers as the recent extirpation of birds in the most northerly parts of the provincial range would not be included in the data set. It appears that most of the decline occurred prior to 1980, and was most severe in the Aspen Parkland Natural Region. Conversely, BBS record species abundance along roadsides and not in the interior of roadless areas or along shrubby waterways. The decline noted in the southern part of the province may be due to the loss of shelterbelts and homestead shrublands, and may not be reflected in the overall population that nests in natural habitats (A. Didiuk pers. comm.). Loggerhead Shrike populations remained strong in the Grassland Natural Region and were relatively stable in that region during the 1980s and 1990s. Wershler and Wallis (1986) considered shrikes as uncommon summer visitors to Onefour that possibly nests on valley slopes.

Habitat

Loggerhead Shrikes inhabit open areas with scattered shrubby growth. They are found in open country, savanna, desert scrub, waterways, open woodland and shelterbelts. The birds use pastures and open areas with telephone poles and fence posts, and can be seen commonly along shrubby waterways in southern Alberta and Saskatchewan.

Threats

Pesticides were an important factor in the decline of Loggerhead Shrikes. As a predator at the top of the food chain, it accumulates persistent chemicals in its tissues. Pesticides may be responsible for slowing the development of young shrikes, for reducing egg shell thickness, and for reducing the size of clutches and broods. The major decline of these shrikes coincided with the use of organochlorines, and although these chemicals are not used anymore, residues are still present in the environment. Little testing for these pesticides in shrike tissue has been done in recent years, although testing of Peregrine Falcons has identified significant residues, possibly acquired in the winter (G. Court pers. comm.). The effect of new pesticides has not been identified. In the Prairie Provinces, new agriculture practices, including the removal of hedgerows, shrubs and

trees and the draining of potholes and sloughs have had the effect of shrinking the habitat available for Loggerhead Shrikes. Road mortalities are a major cause of death, especially for juveniles, as these birds often forage close to roads. The young are also susceptible to heavy rainfall and cold temperatures.

Onefour sightings

Point Count Data

No Loggerhead Shrikes were reported at point counts in 2002. In 2003, one shrike was reported (1.1% of points counts), and in 2005, three shrikes at three points (2.1% of points) were recorded.

Casual Observations

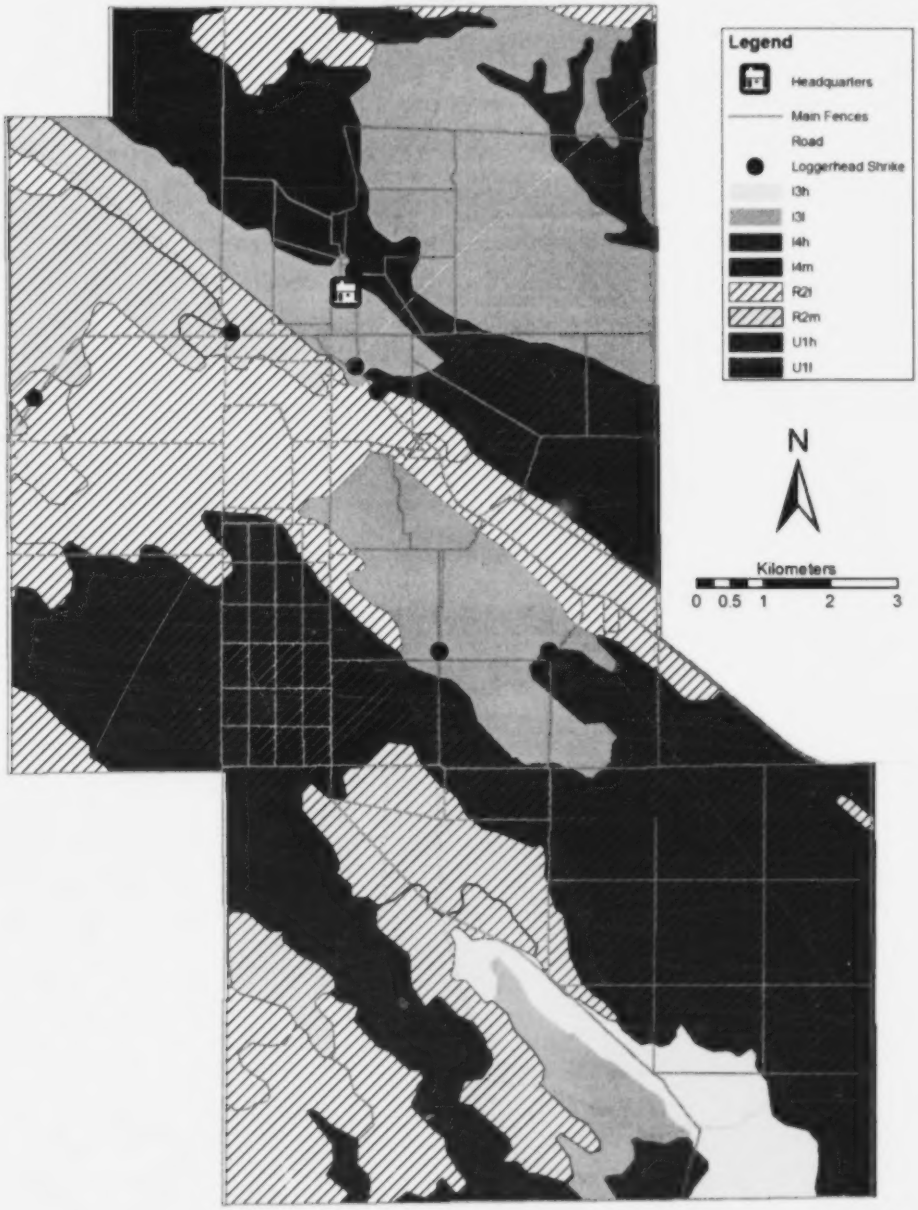
In 2005, we systematically checked all shrubs and trees for nesting shrikes. All sightings of Loggerhead Shrikes were measured by GPS and plotted on a map of Onefour (Figure 12; locations in Appendix 5). In total, there were seven confirmed and likely nesting locations recorded, between June 12 and 23. Of these seven, five nests were located, of which one contained 7 eggs, a second 6 young and a third 5 young. The other two nests were not accessible or were in the process of egg-laying. At the remaining two locations, there were one pair and one single individual, both in appropriate nesting habitat.

Four nests were along Highway 502, three in clumps of willow in the roadside ditches and one in the substation shrubs. Another nest was in a clump of trees and shrubs by a livestock barn. All but the one at the substation were in isolated or very small patches of shrubs. Other shrubs and trees were checked for shrikes but none found in 2005. Nesting habitat for shrikes is very limited at Onefour. The Lost River through Onefour does not have shrubby vegetation along its banks, thus is not suitable nesting habitat.

AGRASID Analysis

The distribution of Loggerhead Shrikes localities at Onefour is a function of suitable nest sites which essentially correlate with the occurrence of clumps of trees and hedgerows (Figure 12). Clumps of cottonwoods and exotic elms close to buildings (the station itself, the livestock barns) and growing along Hwy 502 near ditches were chosen as nesting areas by shrikes. Indeed, nearly all clumps of trees supported a pair of shrikes or had evidence of old nests.

Figure 12. Location of Loggerhead Shrike nests in relation to AGRISID landscape units at Onefour in 2005.



5.3.3 Sprague's Pipit (*Anthus spragueii*)

Background

Distribution and Population

The Sprague's Pipit breeds from the foothills of the Rocky Mountains in southern and central Alberta, to southwestern Manitoba, and south to southern Montana, northern South Dakota and northwestern Minnesota. A single confirmed breeding record also occurred recently in south-central BC. The breeding range appears to have contracted during this century, particularly in the northwestern (Alberta), northeastern (Manitoba), and southeastern (Minnesota) parts of the range. Sprague's Pipits winter in the southern United States and the northern two-thirds of Mexico (Robbins and Dale 1999).

There are no historical estimates of population size for this species, but anecdotal accounts suggest that it was one of the most common grassland songbirds throughout much of its breeding range around the turn of the century. The species remains common in suitable habitat, particularly on the Canadian prairies, and according to Breeding Bird Survey (BBS) data, reaches its highest continental abundance in the southeastern parts of Alberta. However, BBS data collected over the past 30 years show that populations are declining rapidly in many parts of the range. BBS trend data indicated that populations in North America have declined 5 % per year between 1966 and 2004 (Sauer et al. 2005). Populations in Alberta and Saskatchewan, where the highest densities of pipits currently occur, have declined by 6% and 7% per year, respectively, since 1966. Overall in Canada during this period, populations have been declining by 5% a year, with the sharpest decreases occurring in aspen parkland regions (Prescott 1997, Sauer et al. 2005).

In Alberta, Sprague's Pipits were considered to be a "status undetermined" species in the 1991 review of the status of Alberta wildlife (Alberta Fish and Wildlife 1991). The species was updated to the "Blue List" of species that, according to current information, may be at risk in the province (Alberta Wildlife Management Division 1996). This designation was made on the basis of rapidly declining populations, and a lack of research into the biology and management of the species.

Habitat

Native grassland is an important habitat for Sprague's Pipits. The species is rarely found in cultivated lands, or in areas where native grasses have been replaced with introduced forages. In general, the pipits prefer native vegetation of intermediate height and density, with moderate amounts of litter. Such areas tend to occur where habitats are lightly to moderately grazed, or where fires periodically remove vegetation. Areas of suitable habitat must be greater than 140 ha to be attractive as breeding sites for this species (Davis 2004). Habitats may unsuitable for breeding where livestock activity is intense, when native habitat is harvested as hay, when fires are suppressed, or when native grasslands become fragmented by human activities. Wershler and Wallis (1986) stated that pipits were summer residents in ungrazed or lightly grazed grassland.

Threats

Habitat loss is likely the primary cause of historic decline in this species. In particular,

approximately 75% of native grasslands on the Canadian prairies have been lost to cultivation (WWF 1988), which renders the habitat unsuitable for Sprague's Pipits. Among the other factors which may also reduce habitat suitability are: 1) incompatable grazing practices (not only over-grazing but lack of grazing or too conservative stocking rates may also be detrimental), especially intensive grazing, which removes vegetation and may cause reproductive failure due to disturbance and trampling of nests; 2) haying; 3) fragmentation of habitat; and 4) reduction in fire frequency, which encourages encroachment of woody vegetation and promotes excessive growth of vegetation and accumulation of litter. Likely the main factors reducing habitat suitability are 1) a reduction in patch size and increase in edge to area ratio, 2) invasion of exotic species, and 3) encroachment of woody vegetation (Davis 2004). Furthermore, the use of pesticides to control grasshoppers may also impact Sprague's Pipit populations, since grasshoppers are an important food item for the adults and nestlings during the breeding season. The most significant 'natural' limiting factor for the species is probably drought, which affects nesting habitat and possibly food supply at the local level (Prescott 1997).

Onefour sightings

Point Count Data

In 2002, Sprague's Pipits were recorded at nine out of 50 stops, in 2003, 56 Sprague's Pipits at 49 stops, and in 2005, 94 pipits at 72 stops (Appendix 6). The occurrence rate for this species was 18% of points in 2002, 56% of points in 2003 and 51% of points in 2005 (see Figure 13 - 16). The number of pipits per stop likewise increased over the three years (0.2, 1.1, and 1.3 respectively, Figure 17). The contrast across years was pronounced at Onefour as it was across much of southern Alberta. The year 2002 was clearly a poor year for the species, perhaps because of inclement weather that occurred in late spring and likely disrupted breeding activities. In 2005, spring rains caused considerable grass growth by mid May, and indeed it appeared as if Sprague's Pipits were among the most common of passerines.

AGRASID Analysis

The distribution according to landform of the 130 locations where Sprague's Pipits were noted for all three years combined indicates no clear preference for a particular type of landform (Figures 13 - 15). In 2002, most points fell on inclined to steep, single-slope landforms, in 2003, they fell on inclined to steep and undulating with high relief landforms, whereas in 2005 points fell with apparent equal frequency in inclined to steep, ridged and undulating landforms.

Most points (45) were located in grass communities, primarily Needle-and-thread grass-Wheat grass, Needle-and-thread grass-Northern wheat grass-Plains Reed, Needle-and-thread grass-Thread-leafed sedge and Needle-and-thread grass-Blue grama grass-June grass plant communities. There was no particular trend in range site classifications. It is most likely that grass cover is the deciding factor for the occurrence of Sprague's Pipits, rather than any particular type of landform.

Figure 13. Location of Sprague's Pipits in relation to AGRISID landscape units at Onefour in 2002.

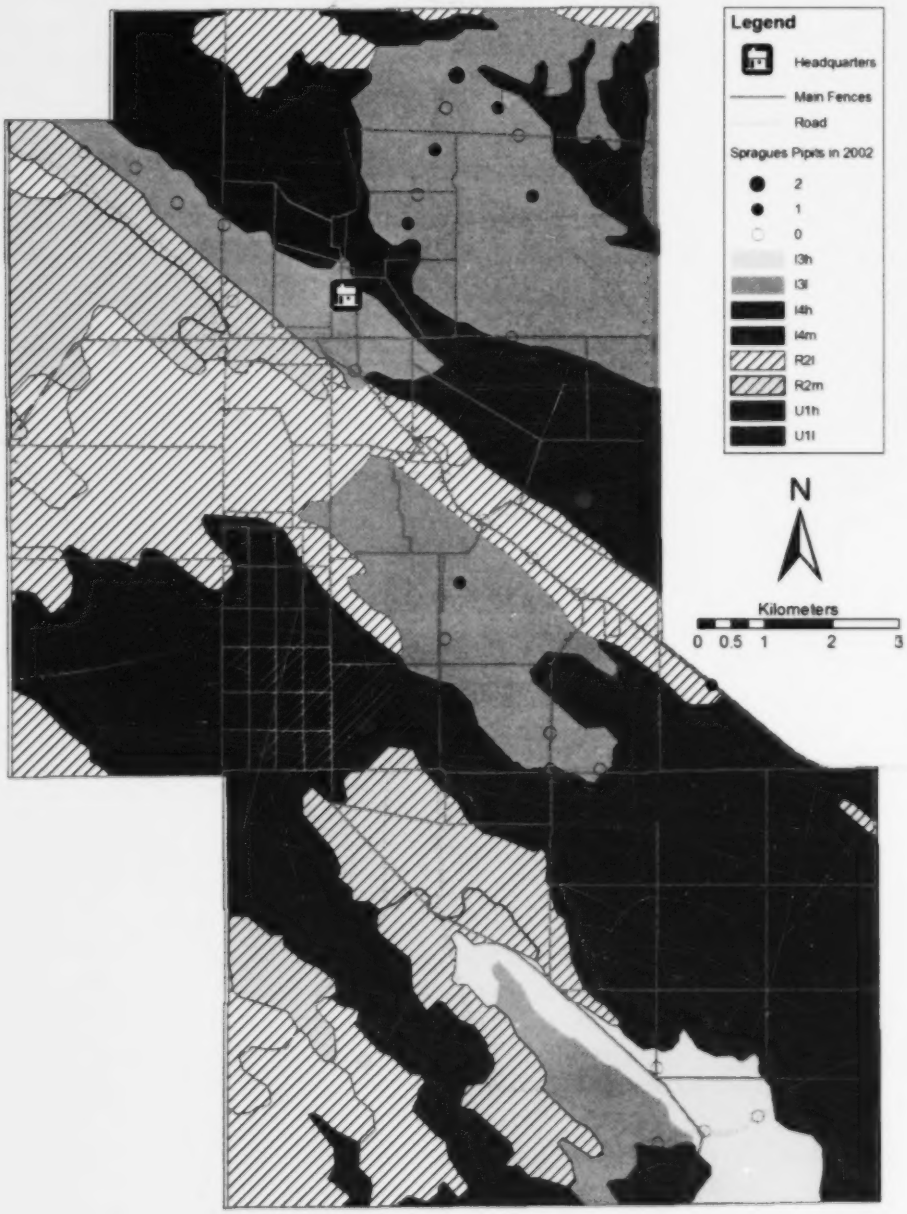


Figure 14. Location of Sprague's Pipits in relation to AGRISID landscape units at Onefour in 2003.

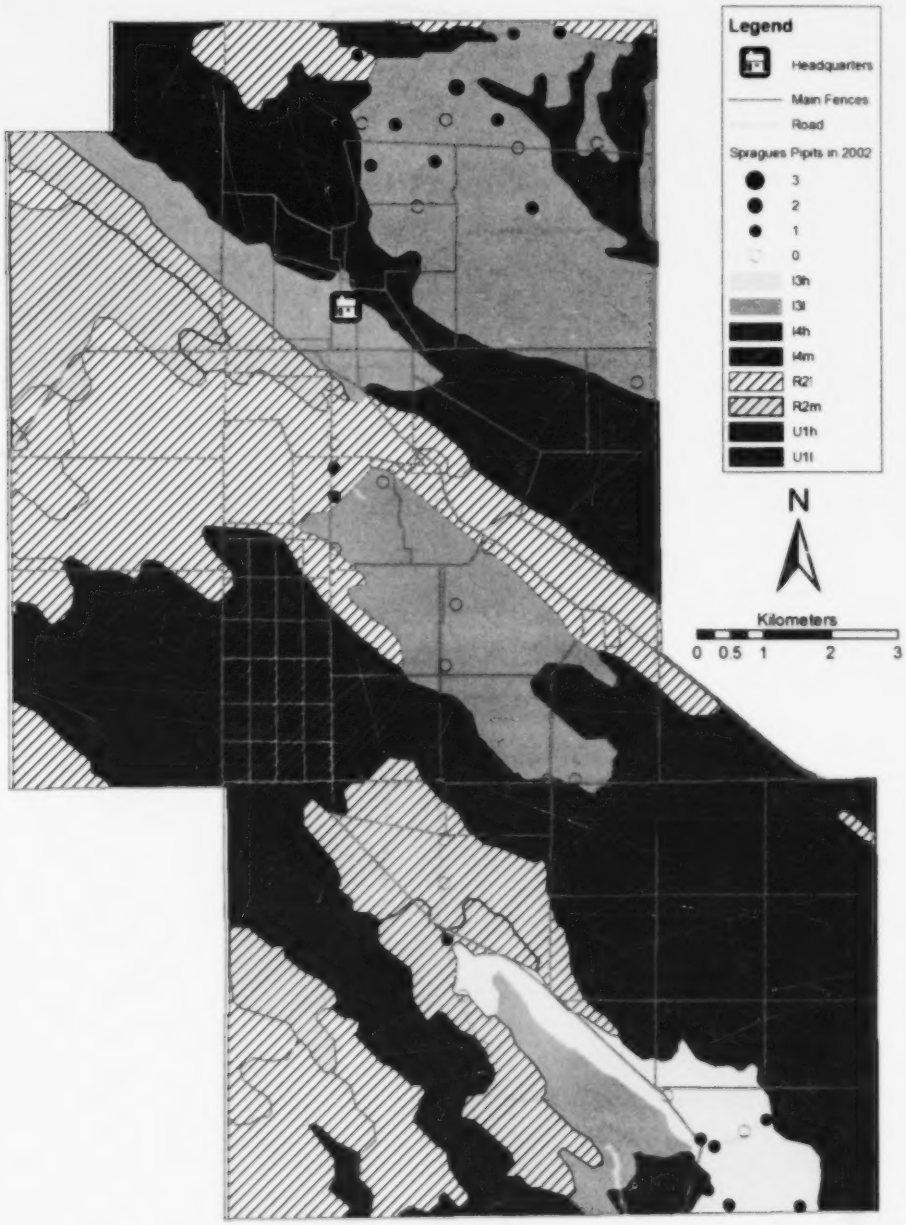
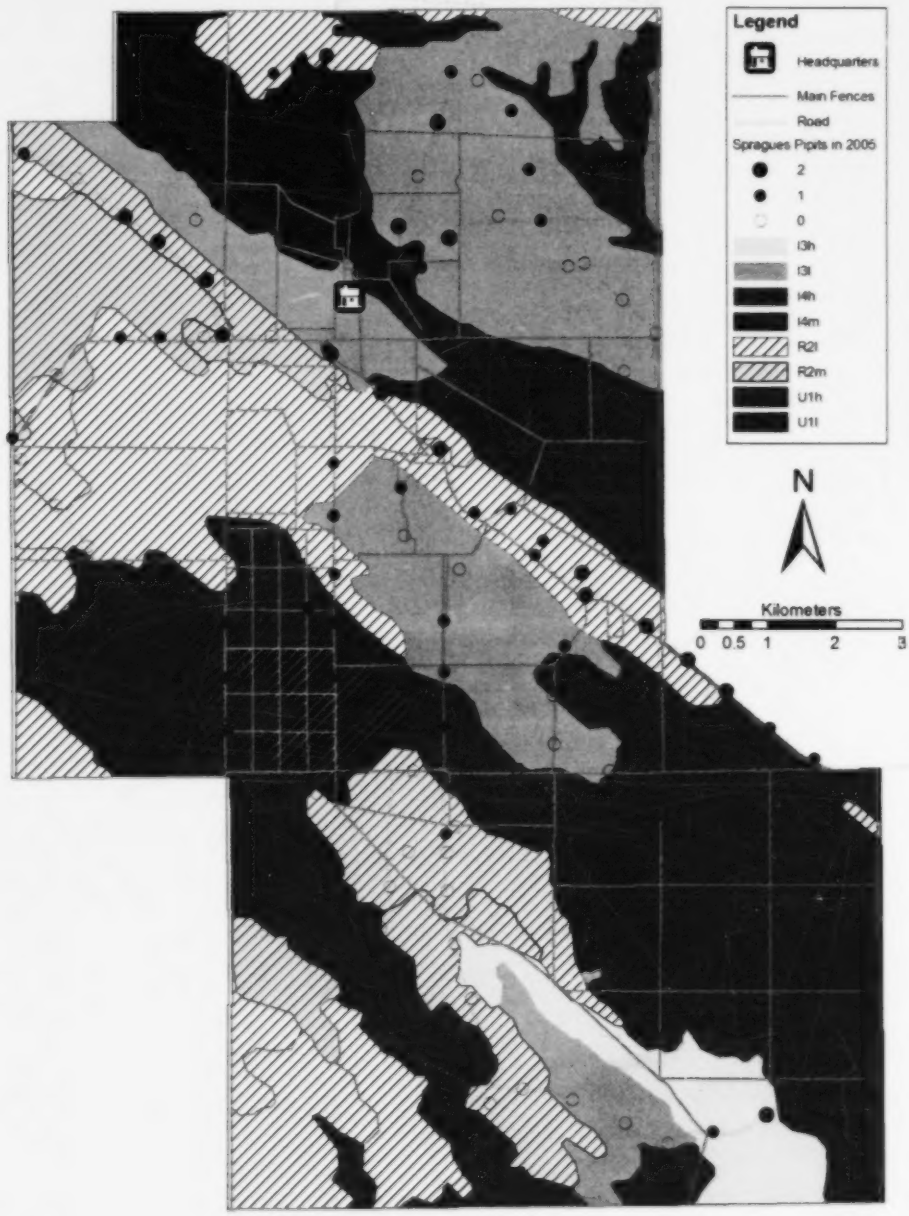


Figure 15. Location of Sprague's Pipits in relation to AGRISID landscape units at Onefour in 2005.



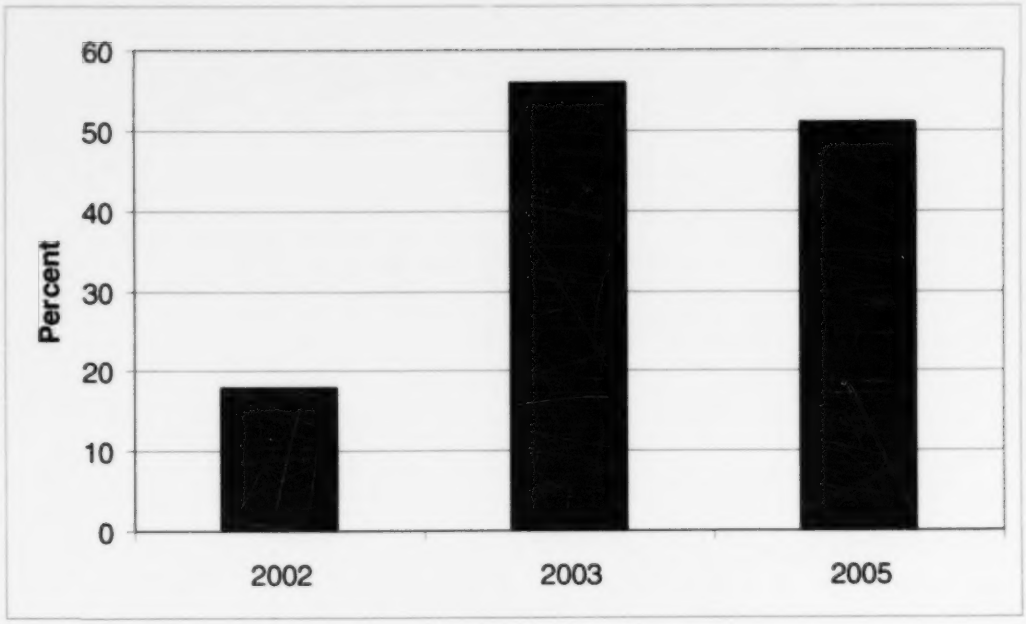


Figure 16. Percent of point counts with Sprague's Pipits identified.

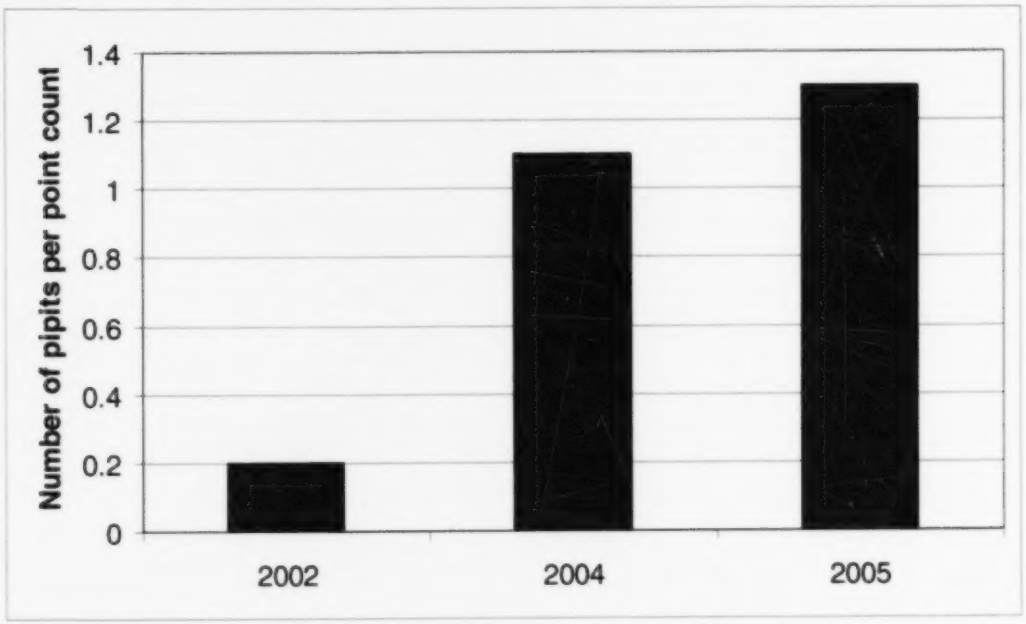


Figure 17. Number of Sprague's Pipits per point count at Onefour.

5.4 Species of Special Concern

5.4.1 Ferruginous Hawk (*Buteo regalis*)

Background

Distribution and Population
Ferruginous Hawks breed from the southern Canadian Prairies and eastern Washington south to Nevada, New Mexico, and northwestern Texas. It winters from the southwestern United States to central Mexico (Watson and Banasch 2003, 2004). The species occupies less than half its historic Canadian range. It now breeds exclusively in the grassland region of southern Alberta, southern Saskatchewan and southwestern Manitoba. The extremely small population of two known nests that exists in British Columbia's southern interior appears to belong to the desert-shrub population mainly located in the inter-mountain basin of the western United States.

Ferruginous Hawk populations have stabilized or increased over the past 25 years, but are significantly lower than they once were. The breeding population in Canada is currently estimated at between 2000 and 4000 pairs, mainly in Alberta and Saskatchewan. Only 50-55 pairs nest in Manitoba. (Schmutz 1999).

In Alberta, the Ferruginous Hawk is currently listed as a 'threatened' species under the Alberta Wildlife Act (Fish and Wildlife Division 2004). A population estimate derived from the survey conducted during 2005 indicates a significant population decline during the past 13 years (Downey 2005). Multiple factors may have contributed to this apparent decline. The species was down-listed from the 1991 provincial 'Red List', to the 'Blue List' in 1996 because, although a substantial decline in their range has occurred, hawk numbers had apparently stabilized and the population was apparently not threatened by chance events exacerbated by small population size (Alberta Fish and Wildlife 1991, Alberta Wildlife Management Division 1996). The Alberta Natural Heritage Information Centre ranks the Ferruginous Hawk as S4 meaning the species is 'apparently secure' in the province (Alberta Natural Heritage Information Centre 1998).

Habitat
The Ferruginous Hawk occupies open, arid habitats dominated by grasses or sagebrush. It prefers an elevated nest site (isolated tree or bush), surrounding grassland over which to hunt, and an adequate supply of ground squirrel prey. It is not found where trees are abundant or land is extensively broken up for cultivation

Threats
The major factor affecting Ferruginous Hawk populations is the loss of grassland habitat, due to extensive agriculture and natural fire suppression. The lack of isolated trees in suitable nesting areas may also be a limiting factor. This hawk is conspicuously absent in grasslands ploughed for grain production; cultivation is suspected to reduce the number of prey species available, hence the number of hawks. Fire suppression has caused the

invasion of grasslands by aspen parkland from the north, pushing the hawk's range southward. Mortality in ground nests is probably extremely high. Indiscriminate shooting may have contributed to the decline as well (Schmutz 1999).

Onefour Sightings

Point Count Data
In 2003, one hawk was reported at one point and in 2005 three birds were reported from one site. Thus, frequency of occurrence is about 1% of points surveyed. In 2005, the three birds constituted a nesting pair with one fairly large young in a nest 10m up in a mature cottonwood, UTM 538499 5443599. This site was occupied each year since 2002. This is likely the only nesting pair of the species in Onefour, and appears to be a traditional site that is used annually. Ferruginous Hawks were seen irregularly through the summer at Onefour, but no other nests sites are suspected. There are reports from the 1970s of abandoned cliff nests along the Lost River south of the Onefour station; these do not appear to have been occupied for several decades (FWMIS 2005). Wershler and Wallis (1986) page 46 state "summer visitor. Occasionally seen flying over study area. Previously nested in badlands along the Lost River and coulees, with at least six old nests found in the study area. In recent years, active tree nests have been found north of the study area."

5.4.2 Long-billed Curlew (*Numenius americanus*)

Background

Distribution and Population
Long-billed Curlews breed from northern Texas eastward to central Nebraska and west to central Oregon and Nevada in the United States, and northwards into southern Saskatchewan, Alberta, and British Columbia. The species breeds throughout southeastern Alberta, bounded in the north by Stettler and in the east by Provost. They are found in the foothills near Calgary and in scattered small populations in central British Columbia south of Prince George. The core of the winter range is in Mexico and the southern coastal states of California, Texas, and Louisiana (Hill 1998).

The Canadian population is estimated at 23 500 birds, 19 000 of which are found in Alberta. In Saskatchewan, there are an estimated 4000 birds, while British Columbia has an estimated 500. The number of Long-billed Curlews breeding in Canada has been relatively stable over the last 10 years, although numbers have declined drastically since the beginning of the 20th century, when they were common through to southern Manitoba and fall migrants could be found on the Atlantic coast of Canada (Hill 1998).

In Alberta, the Long-billed Curlew is currently on the 'Blue List' of species that may be at risk in the province (Alberta Wildlife Management Division 1996). This designation was made based on the low, possibly declining provincial populations, the species' reliance on native grasslands and the lack of specific data on Alberta population trends (Alberta

Wildlife Management Division 1996). The down-listing in 1996 from the 1991 'Red List' was based on better information rather than on an increase in population.

The Nature Conservancy (1998) currently ranks the Long-billed Curlew as 'G5' meaning it is 'demonstrably secure' within its global range. In Alberta, the Long-billed Curlew is ranked as 'S3' or 'rare' (Alberta Natural Heritage Information Centre 1998). Wershler and Wallis (1986) found curlews to be summer residents in grazed grasslands at Onefour.

Habitat
Long-billed Curlews nest in grassland, primarily native short-grass and mid-grass prairie. The birds show a preference for nesting in irregular clumps where they blend in well and perhaps can spot approaching predators more easily. Once the eggs have hatched, the curlews seem to prefer taller, denser grass, possibly because it offers better camouflage for the young and reduces heat stress. Although they are more numerous in native grassland, Long-billed Curlews appear to be able to use some agricultural areas for feeding and raising young.

Threats
At the beginning of the 20th century, Long-billed Curlews were killed for market in large numbers. Cultivation of their native prairie nesting grounds also contributed to early declines; it continues to be a problem, now exacerbated by urban encroachment. Remaining grasslands are fragmented and disturbed by industry, livestock overuse, fire control, and the invasion of exotic plants. While habitat loss is now the greatest threat to the Long-billed Curlew, there is also the problem of increasing risk from predators. Habitat fragmentation may create easier access to the curlews for Coyotes and other predators (Hill 1998).

Onefour sightings

Point Count Data
In 2002, only one Long-billed Curlew was noted. In 2003, 16 curlews were reported at 8 points, and in 2005 69 curlews were reported from 36 points. Thus, curlews occurred at about 9 % of points in 2003 and about 25 % of points in 2005 (Figure 18). However, the species distribution in Onefour is very clumped (Figure 19 – 21, Appendix 7); a glance at the maps indicates that the species occurred primarily in the southern half of Onefour. Of the 44 points where curlews were recorded, all but six occurred south of Hwy 502, and in 2005 curlews occurred at 22 out of 37 points in the southern third of Onefour for an occurrence rate of about 60% in this portion of Onefour.

AGRASID Analysis
The distribution according to landform of the 44 locations where Long-billed Curlews were noted indicates clearly that the preferred landform is undulating with high or low relief (Figures 19 - 21). Twenty-five points occurred in this landscape type. There was no obvious selection of a particular plant community. Fifteen points included silver sage, and the rest (29) were grass communities comprised of various grass species. There did not appear to be any particular trend in range site classifications although perhaps there is

an indication for preference for loamy soils. The curlews appeared to be selecting landscapes that were essentially flat and open, and avoiding those that included steep slopes and ridges.

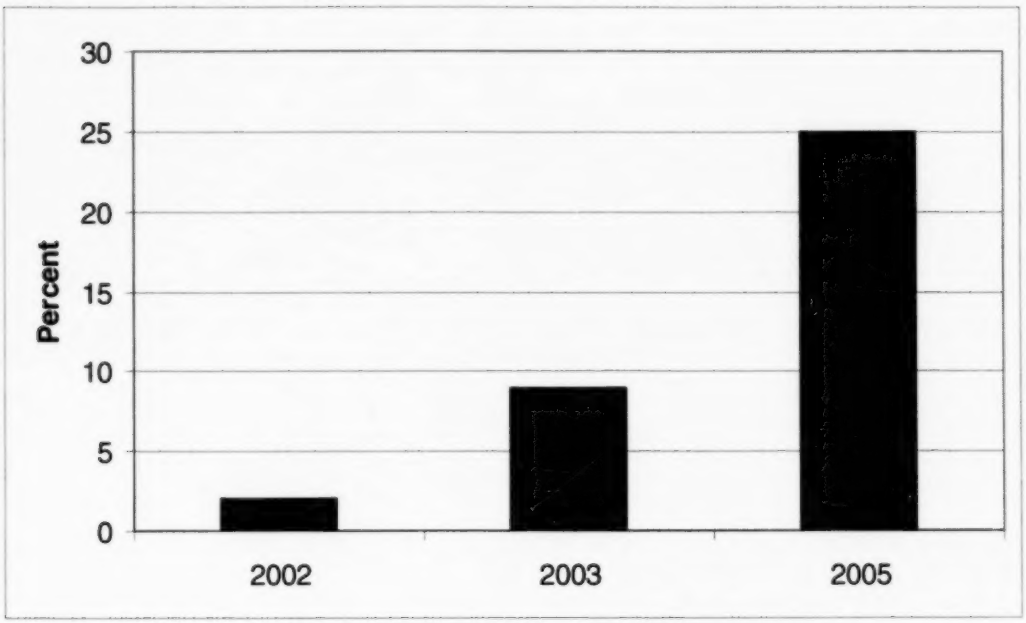


Figure 18. Percent of point counts where Long-billed Curlews were detected.

5.4.3 Short-eared Owl (*Asio flammeus*)

Background

Distribution and Population

The Short-eared Owl is a highly nomadic species that occurs throughout much of the world. This owl responds irruptively on a broad geographic scale to high concentrations of small mammals. Consequently, the migrations and population status of the Short-eared Owl in North America are poorly understood. Populations have declined dramatically in the northeastern U.S. and there is evidence of significant long-term declines elsewhere. The Short-eared Owl breeds in every province and territory, from the southern border to the low Arctic. It is absent from heavily forested areas. Destruction of marshes and native grasslands, coupled with intensive agricultural practices, resulted in the species' decline. During the 20th century, population sizes were thought to have decreased from British Columbia, to Quebec. However, they appear to have remained stable in Newfoundland, Labrador and the Maritimes. The owl currently occurs in small numbers throughout its Canadian range. Exact numbers are not known (Clayton 2000).

Figure 19. Location of Long-billed Curlews in relation to AGRISID landscape units at Onefour in 2002.

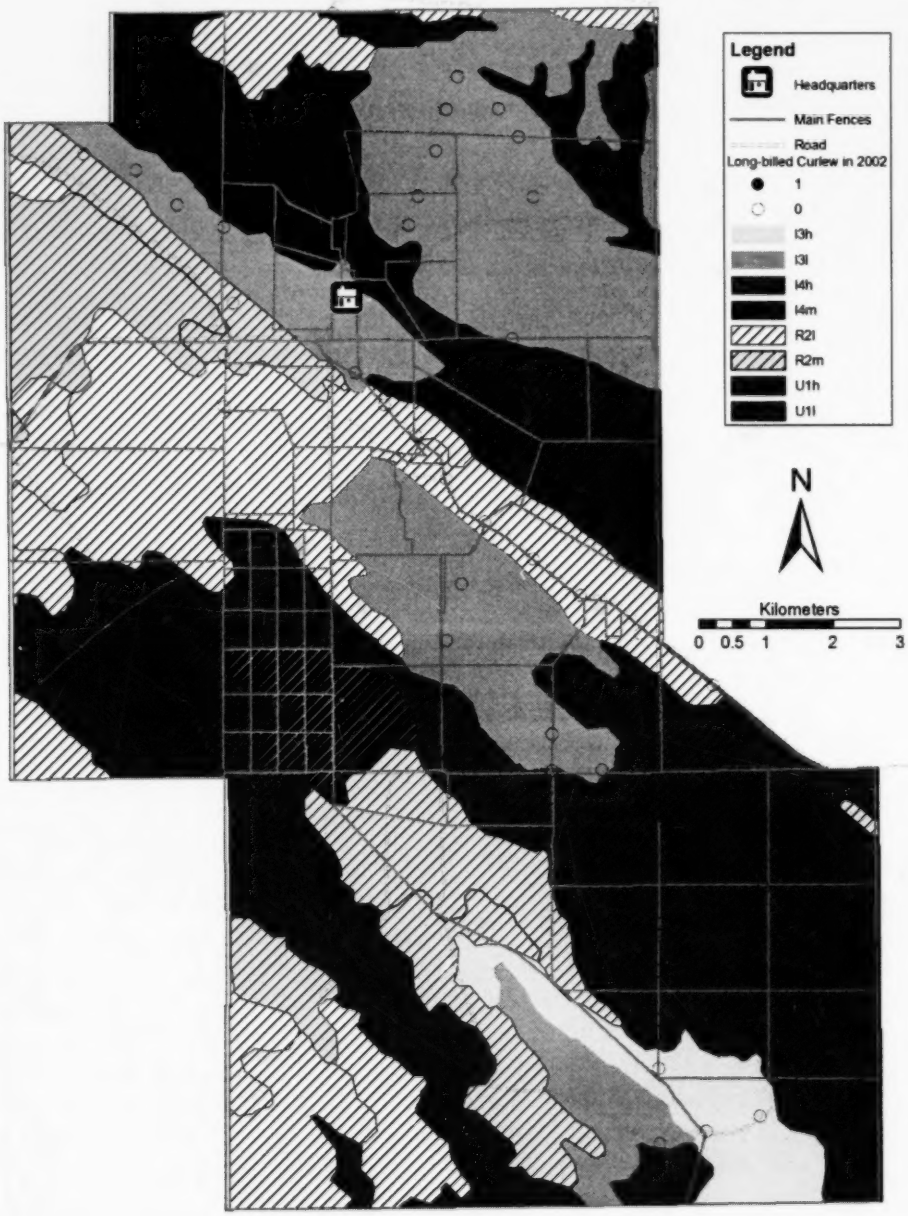


Figure 20. Location of Long-billed Curlews in relation to AGRISID landscape units at Onefour in 2003.

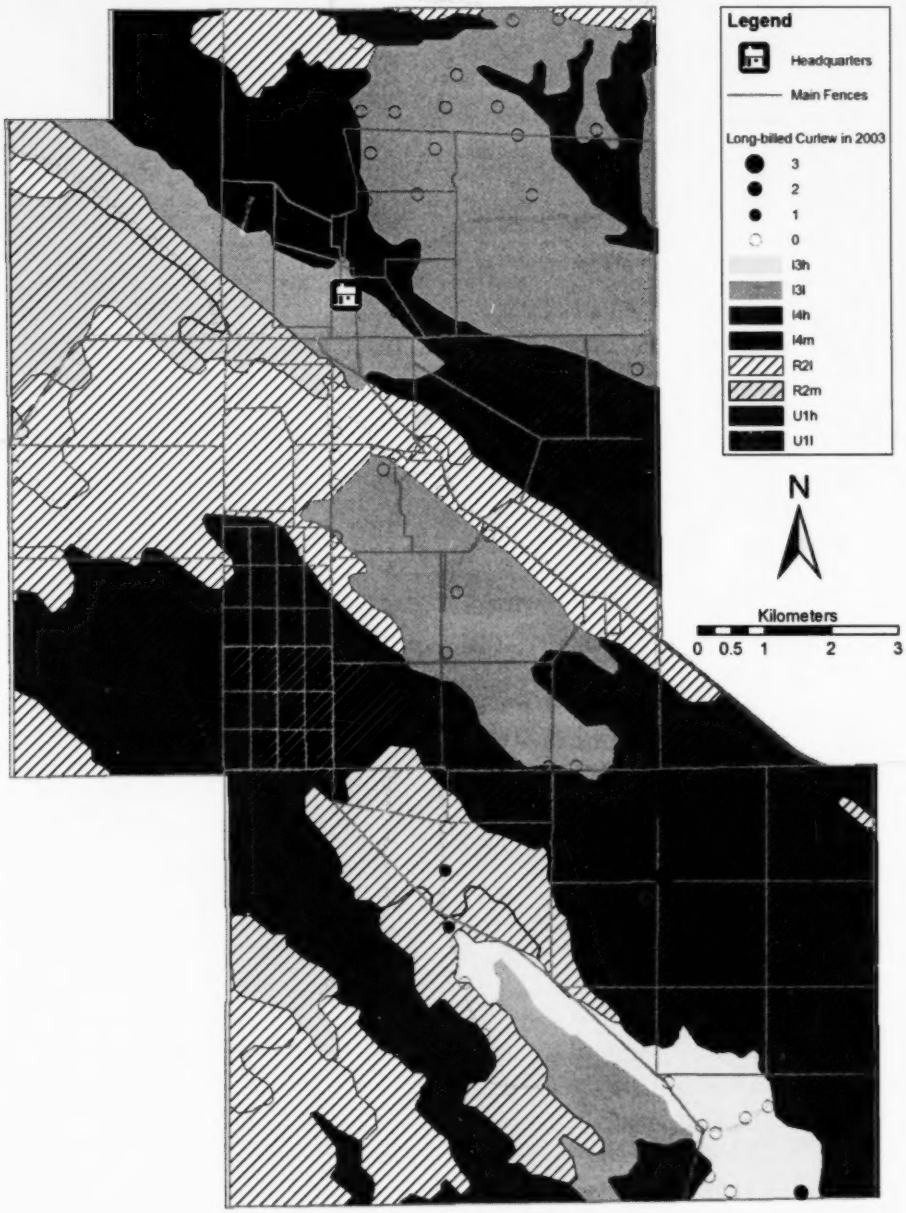
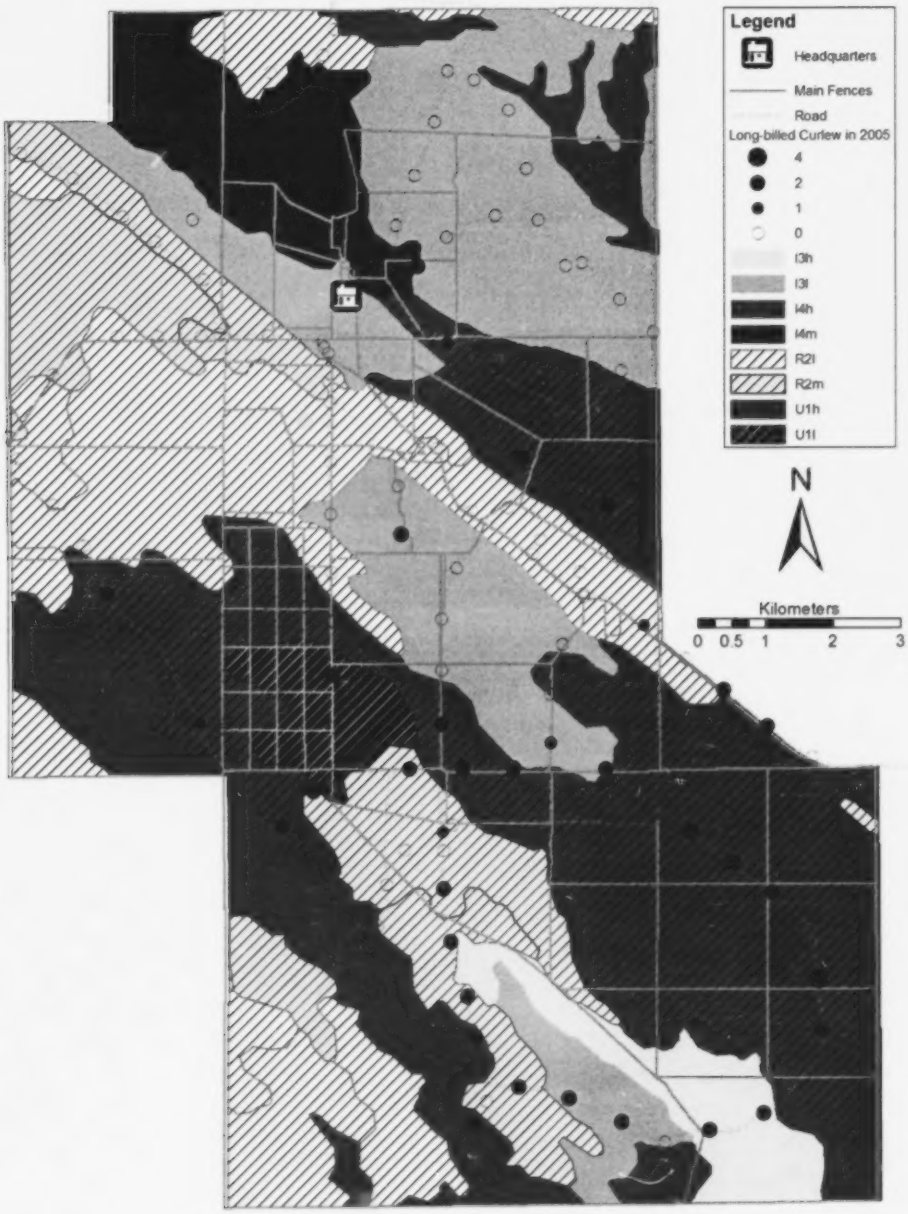


Figure 21. Location of Long-billed Curlews in relation to AGRISID landscape units at Onefour in 2005.



In Alberta, Short-eared Owls occur throughout the non-mountainous regions; there are no current population estimates for this species in the province. Breeding Bird Survey (BBS) data suggest a long-term, although non-significant, decline of this species in the province.

Although specific surveys have not been conducted in Alberta for Short-eared Owls, they were recorded during an extensive survey for Burrowing Owls. In 1994-95, a total of 3431 randomly selected quarter sections from across the prairie region of southern Alberta were searched for nesting Burrowing Owls using a standardized procedure that included playback of recorded calls (Schmutz 1996). Only eight Short-eared Owls were recorded during these surveys. In 1997 and 1998, 109 quarter sections (from the original 3431) in the Hanna region were surveyed yielding 15 Short-eared Owls in 1997, and only one in 1998 (T. I. Wellicome, unpubl. data). Short-eared Owls were unusually common in the Hanna area in 1997 and small mammal trapping suggested that vole numbers were up from the previous year. These data reveal little about the density of nesting Short-eared Owls in Alberta. More importantly, they illustrate the difficulty of assessing the status of a nomadic and irruptive 'population' of highly mobile avian predators.

In Alberta, in 1991, the Short-eared Owl was on Alberta's 'Green List' of species not believed to be at risk in the province (Alberta Fish and Wildlife 1991). The species was moved to the 'Blue List' of species that may be at risk in the province in 1996 because of concern over declines in numbers in the Prairie Provinces and other parts of North America (Alberta Wildlife Management Division 1996). The Alberta Natural Heritage Information Centre has assigned a rank of S3 to breeding Short-eared Owls and S2 to non-breeding (presumably wintering) owls (Alberta Natural Heritage Information Centre 1999a).

Habitat
The owl prefers extensive stretches of relatively open habitat such as marshland and deep grass fields. It hunts and roosts in abandoned pastures, fields, hay meadows, grain stubble, airports, young conifer plantations and marshes in the winter. It frequents prairies, grassy plains or tundra in the summer

Threats
Large-scale destruction of native prairie grasslands has been particularly hard on this species. Natural succession, wetland drainage, urban expansion and increasingly intensive farming have contributed to its decline. The species is exposed to danger from predators and agricultural machinery since it nests on the ground. Effects of environmental contamination are not known. Shooting, collisions with aircraft, trains, cars, barbed wire and farm machinery are added factors. The species' attraction to open airport habitats is another problem (Clayton 2000).

Onefour sightings

Wershler and Wallis (1986) stated they were summer visitors of unpredictable occurrence during years of high vole populations. One bird was reported from the point counts in

2003, the only report in each of the three years in which point count surveys took place. A Short-eared Owl was observed over Hwy 502 just east of Onefour headquarters on June 17, 2004.

Geoff Holroyd and Helen Trefry trapped a Short-eared Owl during Burrowing Owl research on June 14, 2005 at UTM 544918 5434597, and later found a roosting bird on June 22, 2005 at UTM 540671 5433945. Feathers from a plucked dead Short-eared Owl were found near a shelter belt north east of Sheep Camp in July 2005.

5.4.4 Red-headed Woodpecker (*Melanerpes erythrocephalus*)

Background

Distribution and Population
Red-headed Woodpeckers breed from southern Canada south to Florida. In Canada, it breeds in southern Saskatchewan, southern Manitoba, southern Ontario and, on rare occasion, in southwestern Quebec. It no longer breeds in southern New Brunswick. Occasionally it visits southern British Columbia, southern Alberta, central Saskatchewan, New Brunswick and Nova Scotia. Its winter distribution is largely determined by food availability (Page 1996).

The Red-headed Woodpecker is not common anywhere in Canada except, perhaps, in extreme parts of southern Ontario. In Alberta, the species is included on the Green List, indicating a non-breeding migrant or vagrant. Semenchuk (1992) did not consider this species to nest in Alberta.

Habitat
The species is found in thinly treed deciduous forests, woodland and field edges, but also inhabits areas with dead trees, urban parks, farmyards and marsh. It also occurs along rivers and roads with a few large trees. The species appears to prefer open areas with snags and lush herbaceous ground cover, and avoids woods with closed canopies. Historically, its habitat availability increased at the onset of European settlement. The habitat then declined steadily due to forest destruction and dead-tree removal for firewood and esthetics (Page 1996).

Threats
The species is easily disturbed by human activities. Habitat loss is attributable to logging, firewood cutting, agriculture, and dead-tree removal for esthetic purposes. As well, competition from European Starlings for nesting sites, and increased road traffic which leads to birds colliding with cars while stooping for insects along roads, are factors that affect the bird's population (Page 1996).

Onefour sightings

A Red-headed Woodpecker was located by R. Knapton and photographed by J. Duxbury on fence posts along the side road leading into the substation itself on June 4,

2004. The species has evidently occurred irregularly in the vicinity of Onefour for over 20 years, perhaps indicating a small breeding population likely in cottonwoods along the Milk or Lost River riparian communities.

5.4.5 Greater Short-horned Lizard (*Phrynosoma hernandesi*)

Background

Distribution and Population
The Greater Short-horned Lizard is found in the western parts of the Dakotas and Nebraska, and in Montana and the adjacent part of southern Canada, south to eastern Colorado and extreme northeastern Utah. In Canada, it is found in southeastern Alberta and southwestern Saskatchewan. The distribution appears to be disjunct. The Alberta population has eastern and western subgroups, with one group along the South Saskatchewan River, and another group in the Milk River and Pakowski River drainages. In Saskatchewan, the subspecies appears to be restricted to the northwest by the Cypress Hills, to the northeast and east by Pinto Butte and Wood Mountain, and to the west by the boundary hills (Powell and Russell 1992).

The Eastern Short-horned Lizard is the most northerly occurring of all horned lizards (Russell and Bauer 2000) with the northernmost limits of its distribution ranging into southeastern Alberta (Russell and Bauer 2000). Alberta is the only province for which there are population data for this subspecies. Five populations examined in 1979 had a total of 316 individuals. The overall abundance in Alberta appears to have decreased over the past 20 years. Two populations, at 40-Mile Coulee and Medicine Hat, appear to have been extirpated (ASRD 2004).

A review of the status of fish and wildlife resources in 1984 described the Eastern Short-horned Lizard in Alberta as being "threatened" (Alberta Fish and Wildlife 1984). In 1985, a provincial government report placed the Eastern Short-horned Lizard on the list of species considered to be peripheral to the province (Alberta Fish and Wildlife 1985). In 1991, the species was described as being "rare and localized", and was included on the "Red List" as a species considered to be at immediate risk of declining to nonviable levels (Alberta Fish and Wildlife 1991). Most recently, the Eastern Short-horned Lizard has been moved to the provincial "Blue List" of species which may be at risk in the province (Alberta Wildlife Management Division 1996). The lizard is legally designated as a "non-game animal" under the Alberta Wildlife Act. Animals included in this designation are provided with full protection, and may not be killed, possessed, bought or sold without a permit.

Habitat
The Short-horned Lizard is found in a variety of non-desert habitats throughout its range, varying from high-altitude open grassland in Mexico to sagebrush steppe, pine forest, and juniper-pinon woodlands in the southwestern U.S., to sagebrush communities and semi-arid short-grass prairie in southern Canada. It is usually found at high altitudes, but its upper altitudinal limit is closer to sea level in the northern part of its range. Short-horned

Lizards in Alberta generally inhabit sparsely-vegetated, south-facing slopes of coulees and canyons, along the interface between the prairie grassland and the coulee. Individuals in the Milk River Valley area of Alberta are generally found on ecotones such as coulee and canyon rims, but also on the edges of badland areas.

Threats

Climate is thought to be the chief factor determining the distribution of the species at the northern edge of its range, but the precise climatic factor that limits this species is unknown. It is possible that the tight reproductive schedule requires a minimum number of warm days, and that this limits how far north the lizard can successfully reproduce. The strong association of the Eastern subspecies with the warmer, south-facing slopes provides additional evidence that temperature and isolation act strongly to limit the subspecies in the Prairie Provinces. Rock and shale outcrops in Alberta and Saskatchewan provide winter hibernacula, which could also be important in determining the northern limit of the lizard's range.

Onefour sightings

Wildlife service personnel from 2002 through 2005 did not find any Greater Short-horned Lizards at Onefour, however our field work was not in the primary habitat type, nor did we search suitable habitat.

Short-horned Lizards in Alberta occur in discrete areas that are geographically isolated from each other, and therefore vulnerable to local extirpation. Historically, there are records of short-horned lizards "in tributaries of the Milk (River), near the Onefour Federal Research Station" (James 2003) although exact locations for several records in Townships 1 and 2, Range 4 are not known (FWMIS 2005). Wershler and Wallis (1986) reported lizards along the lower Lost River and adjacent coulees in sections 2 and 3, 1-4-W4, and on slopes in the yucca stands. Repeated surveys during 2001 and 2002 (overseen by James) that included the Lost River and Milk Rivers areas at Onefour failed to locate any lizards. This is of particular concern as the next nearest subpopulation is near Manyberries, and hence at too great a distance for recolonization (James 2003). The possibility that the subpopulation at Onefour has been extirpated exists.

5.4.6 Northern Leopard Frog (*Rana pipiens*)

Background

Distribution and Population

The Northern Leopard Frog is a species of cooler climates, and has a range that encompasses most of the northern portion of the United States, extending into all provinces and the Northwest Territories in Canada. Northern Leopard Frogs in Canada from Ontario eastwards belong to the Eastern population, while those in Manitoba, Saskatchewan, Alberta, and the Northwest Territories belong to the Western/Boreal Prairie populations. The Southern Mountain population of the Northern Leopard Frog is limited to the extreme southeastern portion of British Columbia.

In Manitoba, the species was formerly abundant but by 1976, Leopard Frogs had been virtually extirpated from the province. The species has reoccupied much of its historic range, although densities are far below previous levels. In Saskatchewan, the species once ranged across the province south of about 55°N. Populations in this province have greatly declined since the late 1970s. The species is still widespread, but populations tend to be isolated.

In Alberta, the Northern Leopard Frog ranged widely south of 55°N, except in the mountains of the west. By 1979, the species had vanished from most of its range in Alberta. Data from the 1990s show that only 26 of 74 known breeding populations remain, with breeding confirmed in only 12 of these; the majority of these 12 are in the southeastern corner of the province (ASRD 2003).

Habitat

The Northern Leopard Frog uses a variety of habitats to meet its needs throughout the year. Separate sites are generally used for overwintering and breeding. Overwintering sites are well-oxygenated water bodies, such as streams or larger ponds that do not freeze solid; breeding sites are temporary ponds that often dry up in late summer. A typical breeding pond is 30 to 60 m in diameter, 1.5 to 2.0 m deep, located in an open area, with a lot of emergent vegetation, and no fish. In summer the frogs are found in a wide variety of habitats, but usually not in heavily treed areas, in grass that is more than a meter tall, or in open sandy areas. The preferred habitat of the frogs seems to be vegetation 15 to 30 cm tall that is relatively close to water.

Threats

The destruction or modification of the species' breeding, summer, or overwintering habitat, or a change that prevents the frogs from moving from one habitat type to another, can eliminate a local population. Introduction of animals or plants, such as Common Carp or Purple Loosestrife, can make habitat unsuitable for Northern Leopard Frogs. Commercial collection of Northern Leopard Frogs may threaten local populations.

Onefour sightings

There are several historical records of Northern Leopard Frogs at Onefour in the University of Alberta Museum collections from the 1950s and 1960s (Appendix 2 in ASRD 2003), and they were present in ponds north of Onefour in the 1970s (Appendix 3 in ASRD 2003). Wershler and Wallis (1986) reported them along the Lost River during 1974, a relatively wet year.

The 2000-2001 inventories in Alberta failed to produce leopard frogs at four locations at Onefour (Appendix 5b in ASRD 2003) although a small colony was located at Kennedy Creek southwest of Onefour (Appendix 5a in ASRD 2003)

During field research by wildlife service personnel from 2002 through 2005 there were no sightings of leopard frogs at Onefour.

5.4.7 Great Plains Toad (*Bufo cognatus*)

Background

Distribution and Population
The Great Plains Toad occurs throughout western North America and the northern half of Mexico. In Canada, it is likely widely distributed throughout the area bounded by the Alberta-Saskatchewan border to the east, the Trans-Canada Highway and Alberta Provincial Highway No. 3 to the south, the Taber-Vauxhall-Lake Newell area to the west, and the Red Deer River to the north. In Alberta, the species is restricted to the southeastern grasslands; in Saskatchewan, most of the few records are near the Alberta border.

In Alberta, past concerns about declining populations may have been due to lack of investigation during years of higher precipitation, when the species can be detected more readily. More recent surveys (1994, 1996) suggest there are large numbers of the toad at Suffield National Wildlife Area (NWA), Alberta (James 1998).

Although Great Plains Toads were considered by the provincial wildlife status publication of 1984 (Alberta Fish and Wildlife 1984), no specific status was attributed to the species in Alberta at that time. The Great Plains Toads were considered "common throughout its known range in Alberta, decreasing in abundance in the northern and western portions" (Alberta Fish and Wildlife 1984). In 1986 Cottonwood Consultants recommended that Great Plains Toads be considered "endangered" in Alberta. A later document by Butler and Roberts (1987) suggested that the species be considered "potentially threatened" and recommended it receive protective provisions. Wallis and Wershler again recommended an "endangered" status in 1988.

Great Plains Toads were placed on the provincial "Red List" in 1991 (Alberta Fish and Wildlife 1991), and currently remain classified as such (Alberta Environmental Protection 1996). This designation was based on the rare reports of the species, unknown population numbers, and a perception that those populations were declining. They were considered to be of concern because of loss of habitat to drought, drainage, and cultivation of wetlands, and habitat degradation by livestock in the remaining potential breeding ponds (Alberta Environmental Protection 1996).

Habitat
The Great Plains Toad breeds mainly in temporary wetlands that fill with water following heavy rains in late spring and early summer. At Suffield NWA, breeding sites were associated with large, shallow, seasonal wetlands with limited residual growth and some new emergent grass along the margins. During periods of extended drought in Alberta, the toads appear to rely upon irrigated areas for breeding habitat.

Threats
Grassland habitat may be widely available for this species within its range, but many areas of grassland may not include depressions (such as sloughs) suitable for breeding

when high spring runoff or heavy rains trigger breeding. Progressive conversion of grasslands to cropland, application of herbicides and pesticides, and local impacts by grazing, may be slowly reducing the quantity and quality of available habitat.

Onefour sightings

The first record of a Great Plains Toad at or near Onefour is a specimen in the University of Alberta Museum of Zoology collection listed as collected along the Lost River (James 1998).

Since then there have been records at Onefour, mainly along the Lost River, in 1974, 1981, 1990, 1991 (southwest of Onefour by Cleve Wershler), and records at the Lost River ranch in 1975, 1978 (James 1998). Wershler and Wallis (1986) reported they found toads twice: along the sandhills by the Lost River, and calling from impoundment on the southwest side of Lost River. Toads were also reported from the Onefour area during the Southern Alberta Plains Spadefoot and Great Plains Toad Survey, 2002 (FWMIS 2005). It appears as if there are populations of Great Plains Toads clustered in relatively confined areas over the southeastern corner of the province. Wershler and Smith (1992) listed six general population areas in the province of Alberta, one of which includes Onefour in the Lost River / Milk River population area (James 1998).

On June 11, 2005, Geoff Holroyd and Helen Trefry located a Great Plains Toad concealed in a hollow in the old road bed immediately south of highway 502 at UTM 545589 5434030.

5.5 Alberta "Blue-List" Species

5.5.1 Plains Spadefoot Toad (*Spea bombifrons*)

Background

The Plains Spadefoot is a nocturnal toad that spends most of its life underground. The spadefoot toads are not true toads (Family Bufonidae) but belong to the primitive family Pelobatidae. In both the 1991 and 1996 Status of Alberta Wildlife assessments (Alberta Fish and Wildlife 1991, Alberta Wildlife Management Division 1996), the Plains Spadefoot was included on the 'Blue List' of species that may be at risk of declining to non-viable population levels in the province. This status was assigned based on the species' highly variable population status, which is related to the annual availability of breeding wetlands. The Plains Spadefoot is included on the Alberta Natural Heritage Information Centre's 1999 watch list and is ranked as S3 (Lauzon 1999).

Butler and Roberts (1987) included the Plains Spadefoot among seven reptiles and amphibians in Alberta, most of which occur in prairie habitats, that are uncommon enough to be considered threatened and deserve "special consideration". The Prairie Conservation Action Plan (World Wildlife Fund 1988) recognized 10 species of reptiles

and amphibians, including the Plains Spadefoot, as species of concern. In Alberta, the Plains Spadefoot is protected as a non-game species under the Alberta Wildlife Act.

In Alberta, the Plains Spadefoot primarily occurs in the Grassland Natural Region. Within these Natural Regions, the Plains Spadefoot occurs in the Dry Mixedgrass in which Onefour is located. Recent increases in observers and search effort has likely resulted in more sighting locations. The paucity of historic records for the species makes it difficult to assess whether the range of the Plains Spadefoot in Alberta is expanding, contracting, or stable (Lauzon 1999).

Onefour sightings

Extensive field research by wildlife service personnel from 2002 through 2005 did not reveal any sightings of Plains Spadefoots at Onefour.

There are several records of Plains Spadefoot Toads in Townships 1 and 2, Range 4 in which Onefour occurs (FWMIS 2005). Of these, two refer specifically to Onefour, in 1987 and 1989. On July 8, 1987, C. Wershler reported over 100 individual adults with an undetermined number of larvae in a creek and a pool of a tributary stream on the station property, and on June 15 Wershler reported two along the Lost River (Lauzon 1999).

5.5.2 Prairie Rattlesnake (*Crotalus viridis viridis*)

Background

Of the eight subspecies of the Western Rattlesnake in North America, the Prairie Rattlesnake is the one found in Alberta (Behler and King 1979, Russell and Bauer 2000). In Alberta, the Prairie Rattlesnake is a "Blue-listed" species, indicating that it may be "at risk" and susceptible to habitat disturbance, population decline, or reductions in provincial distribution (Alberta Wildlife Management Division 1996). In Saskatchewan, its distribution is limited and it is thought to be "threatened" (Secoy 1987), whereas in Montana, this subspecies is considered to be widely distributed and abundant (Reichel and Flath 1995).

Although historical information on Prairie Rattlesnake populations in Alberta is limited, anecdotal reports indicate that numbers have decreased since European settlers arrived in western Canada (MacArtney and Weichel 1993). It has been suggested that most dens in Alberta currently contain less than one hundred rattlesnakes, whereas historically, some den sites may have housed several hundred individuals (Watson and Russell 1997).

Under the 1987 Alberta Wildlife Act, Prairie Rattlesnakes were listed as "non-licence animals" (Alberta Fish and Wildlife 1989) which can generally be hunted or harvested without a permit. Specific restrictions, however, prevented the sale or live possession of Prairie Rattlesnakes, and hibernacula were offered protection from disturbance between September 1 and April 30. In January 1997, the legal designation of the Prairie Rattlesnake was changed to "non-game animal". This new designation increased the

amount of protection available for this species by making it illegal to kill, possess, buy or sell rattlesnakes in Alberta. Despite these legal regulations, rattlesnakes can still be killed if they pose a threat to individual safety.

One of the first unofficial status designations for the Prairie Rattlesnake in Alberta was assigned by the Alberta Committee on Rare and Endangered Species, which described this species as "locally abundant in southeastern Alberta" (Anonymous 1984). In 1991, the Prairie Rattlesnake was designated as a "Blue-listed" species in Alberta (Alberta Fish and Wildlife 1991), and has retained this status in a recent revision (Alberta Wildlife Management Division 1996). As a "Blue-listed" species, the Prairie Rattlesnake "may be at risk" and, although not immediately threatened, the species is thought to be susceptible to habitat disturbance, population decline, or reductions in provincial distribution (Alberta Wildlife Management Division 1996).

Onefour sightings

Records of prairie rattlesnakes at Onefour date back to the 1950s (Watson and Russell 1997), and the species was classed as "numerous" in the period 1979 – 1983 by L. Powell. Wershler and Wallis (1986) reported they were occasionally encountered in badlands, grasslands near the valley edge and in sandhills.

Rattlesnakes were encountered fairly frequently at Onefour from 2002 through 2005, with numerous records along Hwy 502 especially in the mornings after a night of cool temperatures. A one metre long snake was found dead on the road on July 5, 2005 (I. Walker, pers.com.). Rattlesnakes were recorded fairly often in both Burrowing Owl and badger burrows during field research by Wildlife personnel; the following are examples of rattlesnake reports;
June 12, 2005, an 80 cm long snake was found in an owl burrow at 543703/5435608;
June 16, 2005, a 60cm long snake by an owl burrow at 540954/5444801;
June 24, 2005, a 60cm long snake in a badger burrow at 547044/543108
July 6, 2005 a 60cm long snake at an owl burrow at 545976/5431548 (H. Trefry, pers.com.).

5.5.3 Western Hog-nosed Snake (*Heterodon nasicus nasicus*)

Background

Three subspecies of the Western Hog-nosed Snake are currently described (Conant and Collins 1991). The nominate race, the Plains Hognose Snake (*H. n. nasicus*) is the subspecies found in Saskatchewan, Manitoba, and Alberta, where its range enters into the extreme southeastern corner of the province.

In 1991, due to the perception of its extreme rarity in the province, the Western Hog-nosed Snake was included on Alberta's 'Red List' of species at risk of declining to non-viable population levels (Alberta Fish and Wildlife 1991). Recent studies have greatly increased our limited knowledge of this snake. Currently, the Plains Hog-nosed Snake is

on Alberta's 'Blue List' of species that may be at risk in the province (Alberta Wildlife Management Division 1996). The emerging picture is one of an extremely secretive and elusive creature. The question now is whether the Plains Hog-nosed Snake is truly 'rare' in Alberta, or whether it is just rarely seen (Wright and Didiuk 1998).

Records from Alberta suggest that the Plains Hog-nosed Snake prefers predominantly or completely sandy locations within the grasslands region (Pendlebury 1976, Smith and Wershler 1989). Two records, the first from the Milk River south of Comrey (Wright and Didiuk 1998), and the second from the Comrey breaks (G. L. Powell, pers. comm.), place this snake on the coulee rim, grassland/badlands ecotone, where clay soil and/or gravel, scattered rocks, jumbled boulders and ground juniper are the prominent features (Wright and Didiuk 1998).

In Alberta, the apparent preference of Plains Hog-nosed Snake for sandy soils results in these habitats being most frequently searched by biologists. Recent records, however, show that the Plains Hognose Snake occurs in more diverse habitat than was formerly believed. The records include captures on, and adjacent to, Canadian Forces Base (CFB) Suffield, where the species was trapped without any habitat bias, and two recent (1997) road-kills from the area immediately northeast of Medicine Hat. Specimens from CFB Suffield were collected on open prairie with sandy substrate, on open prairie with heavy sod, on open prairie near sloughs, on gravelly rolling glacial till plain, on open dune sandhill country, and on a riparian sageflat with densely packed soil conditions. Of the two recent road-kills mentioned above, one was on a gravel road bordered for many kilometers by overgrazed rangeland with heavy sod, and the other was on a major highway bordered on either side by canola fields with a grassy, 20 m right-of-way (Wright and Didiuk 1998).

Plains Hog-nosed Snakes have been captured in Alberta in sandy areas where Northern Pocket Gophers (*Thomomys talpoides*) are abundant. It is possible that the winter burrows of this rodent, which extend below the line of frost-penetration, provide suitable hibernacula for the snake, allowing it to remain year-round on its summer range.

Onefour sightings

Two records of hog-nosed snakes at Onefour exist (Wright and Didiuk 1998). A specimen in the University of Alberta Museum collections from 1961, collected by E. Stribney at UTM 49°04' 49" N, 110°30' 15" W would place the collection site at Onefour. The next record is a sighting north of the Lost River canyon at Onefour in 1980 (UTM 49°04'04" N, 110°30'18" W) by L. Powell.

During extensive field work by wildlife service personnel from 2002 through 2005 there were no sightings of hog-nosed snakes at Onefour.

6. RECOMMENDATIONS

In this report we have provided a detailed overview of the occurrence of vertebrate species at risk at Onefour.. The fact that so many species occur on the substation is likely a result of the large extent of native grassland remaining at the Onefour station and surrounding area with minimal development. While historical management practices that included seeding roughly 30% of the station into tame grasses limits the area available for use by some species, Onefour remains a testament to the compatibility of the land use management and the habitat needs of the species at risk. The historical trends of the species at Onefour are not known but the well documented decline of grassland bird species throughout the Canadian prairies and in many cases, a severe range contraction from the north, highlights the importance of areas like Onefour located at the southern limit of the grassland range in Canada.

Future studies at the sub-station should focus on the land use management to determine what aspects of the activities at the station make it suitable to so many species at risk and how to ensure all species remain part of the landscape over time. The research use of the area is undergoing changes and the needs of the species at risk and other grassland species should be included in the new management plans. As an example, our research focused on the Burrowing Owl has revealed the distribution of owls is patchy, their numbers fluctuate greatly, and there are few fossorial mammals to create burrows. While the affects of management practices on ground squirrel populations needs to be examined it must be in conjunction with how changes might negatively affect other species. In addition specific features are related to specific aspects of the life history of species at risk. For example specific soil types are related to burrow stability for burrowing owls nests and underground cavities that are used as snake hibernacula. Such features need to be examined as they relate to species at risk.

Thus we recommend that the next step in the management of species at risk is to develop a SAR management plan that would relate the known habitat needs of the species at risk found at Onefour with the best management practices that provide these needs yet meet the livestock research and management objectives of the station.

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http://www3.gov.ab.ca/srd/fw/status/reports/hognose/index.html

http://www3.gov.ab.ca/srd/fw/status/reports/hognose/index.html

http://jrm.library.arizona.edu/data/1994/475/10smit.pdf

http://www.cd.gov.ab.ca/preserving/parks/anhic/drymixedgrass.asp

http://www.cd.gov.ab.ca/preserving/parks/anhic/docs/esa_ab_vol2.pdf

http://www.sararegistry.gc.ca/status/showASCII_e.cfm?ocid=612

http://www3.gov.ab.ca/srd/fw/status/1996/status.html

http://www3.gov.ab.ca/srd/fw/status/reports/pdf/sage_thrasher.pdf

http://www3.gov.ab.ca/srd/fw/status/reports/pdf/shli.pdf

http://www.cd.gov.ab.ca/preserving/parks/anhic/birds_tracking.asp).

http://www3.gov.ab.ca/srd/fw/status/reports/sgrouse/index.html

http://www3.gov.ab.ca/srd/fw/status/reports/pipit/index.html

http://www3.gov.ab.ca/srd/fw/status/reports/fhawk/index.html

8.0 ACKNOWLEDGEMENTS

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APPENDIX 1. Species Classifications by Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2001)

Extinct	A species that no longer exists.
Extirpated	A species that no longer exists in the wild in Canada, but occurs elsewhere.
Endangered	A species facing imminent extirpation or extinction
Threatened	A species that is likely to become endangered if limiting factors are not reversed.
Special Concern	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
Not at Risk	A species that has been evaluated and found to be not at risk
Data Deficient	A species for which there is insufficient scientific information to support status designation.

APPENDIX 2. Additional Species at Risk at Onefour

Endangered: Yucca Moth *Tegeticula yuccasella*
Threatened: Soapweed (Yucca) *Yucca glauca*

The Onefour yucca/yucca moth population is considered stable/increasing (J. Nicholson, pers. comm.).

Yucca Moths (*Tegeticula yuccasella*) are small white moths with a wingspan of 18 - 27.5 mm. They are most easily identified by their presence within Yucca flowers. The different closely related species, all of which are generally referred to as yucca moths, are difficult to distinguish without examination under a microscope. For clarity, Yucca Moth (capitalized) will be used throughout to refer specifically to *Tegeticula yuccasella*. (COSEWIC 2002).

Yucca Moths are members of the family Prodoxidae. They are characterized by a mutually beneficial association with Soapweed (family Agavaceae), and have specialized mouth parts with which to actively pollinate their host species.

Distribution

The Yucca Moth is found in Soapweed populations throughout the Great Plains from southern Texas to southern Canada. In Canada, the only sustainable population exists in Alberta at Onefour in one of only two native populations of Soapweed. In addition to Onefour, another native population of Soapweed in the Pinhorn Grazing Reserve, also in Alberta, has few if any Yucca Moths.

Yucca Moths are restricted to Soapweed populations in Canada. Soapweed occupies 2-km stretch of south-facing coulee slope of a tributary of the Milk River in southeastern Alberta. In the more central and southern parts of the species' range, Soapweed flourishes on flat prairie grasslands.

Population sizes and trends

In 1998, a complete census revealed 255 Yucca Moth larvae at the Onefour site, about 75-90 of which became adults. The Pinhorn population has not produced any new larvae from 1997-2002. There are no long-term data available to assess population decline and no trends were apparent from indices measured between 1998 and 2002. Populations of this species undergo dramatic fluctuations

At the northern edge of its range in Alberta and Montana, the Yucca Moth uses only Soapweed for oviposition and for larval feeding. There is no other Yucca sp. naturally occurring within Canada that could act as a host plant for the Yucca Moth. This plant grows in sparsely distributed populations on well-drained, mostly south-facing coulee slopes. Typically, these slopes are eroded, dry and sparsely vegetated with prickly pear

cactus and silver sagebrush. The aspects of slopes supporting Soapweed in Alberta range from 34° (northeast) to 200° (south-southwest), and generally face away from prevailing southwest winds, except in cases where slopes are protected by adjacent slopes. Soils tend to be alkaline and regosolic without shallow hardpan (COSEWIC 2002).

Hurlburt (2004), in a six year study of moth/yucca mutualisms at Onefour, found that both the moth and yucca populations were resilient to variation in both biological and environmental conditions. She found that this northern population of yuccas was stable, in spite of high variation in reproductive output and herbivory, and the stability was a result of persistence of mature reproductive individuals in the population, rather than reproduction and recruitment of seedlings. The small population of yuccas was not restricted to outcrossing; the plants readily retained self fed flowers with no apparent effect on progeny. She concluded that the mutualistic interaction between yuccas and moths is stable at the northern edge of its range at Onefour, such that this northern population does not necessarily exhibit increased susceptibility to extinction from low abundance and high demographic variability. They have the capacity to adapt and evolve new life history strategies to survive in harsh, variable environments.

APPENDIX 3. UTM Co-ordinates for the location of Mountain Plover sightings at Onefour from 1979 to 2005. Most recent records are listed first. AHY=Adult, HY= young of year, U=unknown

LAT./LONG.	DATE	NO. MOPL OBS	AGE/ SEX	COMMENTS	OBSERVER(S)	DATA SOURCE AND REFERENCE
49.053932 110.451654	22/06/05	1	AHY	Nest with 3 eggs; checked nest on 07/05/2005-empty, no bird seen, nest intact, no eggshells	G. HOLROYD, H. TREFRY, R. KNAPTON	CWS, H. TREFRY-FIELD NOTES
49.053932 110.451654	24/06/05	3		Observed 2 MOPL feeding and same MOPL on nest as above.	R. KNAPTON	CWS, R. KNAPTON – FIELD NOTES
49.056423 110.472678	29/05/01	1	AHY	Wershlers final report says this adult was found in late April	IAN WALKER-ONEFOUR SUB-STATION MANAGER	BSOD WERSHLER, C. 2001
49.00000 110.138709	12/5/1994	1	AHY/ U	nest (3 eggs)	T. SADLER (PERS. COMM.)	WERSHLER, C. 2000.
49.01444 110.161117	7/5/1994	1	AHY/ U		P. ROXBURGH (PERS. COMM.)	WERSHLER, C. 2000
49.055819 110.137896	14/06/90	1	AHY/ U	nest (3 eggs)-Bird on nest with eggs seen in area of sagebrush flats	ALBERTA FISH AND WILDLIFE STAFF	BSOD WERSHLER, C. 2000.
49.053513 110.457048	27/08/88	2	1AHY/ U; 1HY	fledged young	C.R.WERSHLER	BSOD WERSHLER, C.R. 1990
49.049894 110.462672	16/07/88	4	2AHY/ U; 2HY	downy or recently fledged young observed	B. STORMS (PERS. COMM.)	BSOD WERSHLER, C.R. 1990
49.060842 110.468156	20/06/88	2	AHY/ U	nest (3 eggs)	W. SMITH	BSOD WERSHLER, C.R. 1990
49.053513 110.457048	15/05/85	2	AHY/ U	nest (3 eggs): rechecked on May 28, 1985-no adult found and nest was empty	C. WALLIS AND C.R. WERSHLER	BSOD WERSHLER, C.R. AND C.A. WALLIS. 1986.
49.050000 110.46267	26/04/85	2	AHY/ U		C. WALLIS AND C.R. WERSHLER	WERSHLER, C.R. AND C.A. WALLIS. 1986.
49.049894 110.462672	1/1/1983	2	AHY/ U	at least 2 adults observed	A. WISLEY (PERS. COMM.)	BSOD WERSHLER, C.R. AND C.A. WALLIS. 1986.
49.000000 110.450000	4/7/1982	2	AHY/ U		UNKN	AMERICAN BIRDS 1982
49.053513 110.468158	30/04/82	6	AHY/ U	not flocked	C. WALLIS AND C.R. WERSHLER	BSOD WERSHLER, C.R. AND C.A. WALLIS. 1986.
49.053515 110.490378	15/06/81	4	AHY/ U	at least 2 apparent broods	C. WALLIS AND C.R. WERSHLER	BSOD WERSHLER, C.R. AND C.A. WALLIS. 1986.

LAT./LONG.	DATE	NO. MOPL OBS	AGE/ SEX	COMMENTS	OBSERVER(S)	DATA SOURCE AND REFERENCE
49.053513 110.457048	18-20/05/81	11	AHY/ U	at least 11 adults; 6 nests (3 eggs each); habitat was heavily grazed sandy mixed grassland on level topography, used as winter pasture	C. WALLIS AND C.R. WERSHLER	BSOD WERSHLER, C.R. AND C.A. WALLIS. 1986.
49.053513 110.457048	20-21/06/80	6	AHY/ U	Occupied nest- adult seen attending nest or incubating; at least 3 apparent broods	C. WALLIS AND C.R. WERSHLER	BSOD WERSHLER, C.R. AND C.A. WALLIS. 1986.
49.020000 110.440000	14/07/79	3	AHY/ U		W. SMITH	WALLIS, C.A. AND C.R. WERSHLER. 1981.
49.020000 110.440000	11/7/1979	9	4AHY/ U; 5HY/U	5 unfledged young	C. WALLIS AND C.R. WERSHLER	WALLIS, C.A. AND C.R. WERSHLER. 1981.
49.020758 110.440449	9-10/06/79	4	3AHY/ U; HY/U	2 nests (3 eggs each); newly hatched young	R. WERSHLER	BSOD WALLIS, C.A. AND C.R. WERSHLER. 1981.
49.017137 110.434815	4-5/06/79	4	AHY/ U	nest (3 eggs)	C.R.WERSHLER	BSOD WALLIS, C.A. AND C.R. WERSHLER. 1981.
49.020000 110.440000	14/06/79	12	3AHY/ U; 9HY/U	3 broods each with 3 newly hatched young	C. WALLIS AND C.R. WERSHLER	WALLIS, C.A. AND C.R. WERSHLER. 1981.
49.009903 110.445945	25/05/79	2	AHY/ U	at least 2 birds seen; nest found with 3 eggs	V. LOEWEN AND C. WALLIS	BSOD WALLIS, C.A. AND V. LOEWEN. 1980.
49.155551 110.423688	30/09/77	5	2AHY/ U;3HY /U	Pair with brood observed; area of level grassland within shallow badlands and solonetzic soil	W. SMITH AND C. WALLIS	BSOD WALLIS, C.A. AND C.R. WERSHLER. 1981.
49.042638 110.473792	5/7/1971	2	AHY/ U		W.R. SALT, J.R. SALT	BSOD SALT, W.R. AND J.R. SALT. 1976

APPENDIX 4. UTM Co-ordinates for the location of Burrowing Owl nests at Onefour in 2002 – 2005

Year	Easting	Northing	Zone	Datum		Year	Easting	Northing	Zone	Datum
2002	538487	5438756	12 U	NAD 27		2005	539666	5441366	12U	NAD 27
2002	540261	5432913	12 U	NAD 27		2005	540261	5432913	12U	NAD 27
2002	543390	5432919	12 U	NAD 27		2005	543529	5433147	12U	NAD 27
2002	545689	5430133	12 U	NAD 27		2005	544177	5432760	12U	NAD 27
2003	538487	5438756	12U	NAD 27		2005	545108	5432356	12U	NAD 27
2003	543390	5432919	12U	NAD 27		2005	544522	5431290	12U	NAD 27
2003	544177	5432760	12U	NAD 27		2005	540954	5444801	12U	NAD 27
2003	543529	543347	12U	NAD 27		2005	545976	5431548	12U	NAD 27
2003	545108	5432356	12U	NAD 27		2005	540238	5435529	12U	NAD 27
2003	545684	5430342	12U	NAD 27		2005	544577	5431945	12U	NAD 27
2003	540330	5441697	12U	NAD 27		2005	542176	5433404	12U	NAD 27
2003	539666	5441366	12U	NAD 27		2005	542217	5440273	12U	NAD 83
2003	545689	5430133	12U	NAD 27		2005	544072	5432629	12U	NAD 83
2003	546403	5428943	12U	NAD 27		2005	539695	5440219	12U	NAD 83
2004	539666	5441366	12U	NAD 27		2005	545652	5430796	12U	NAD 83
2004	540261	5432913	12U	NAD 27		2005	545572	5431788	12U	NAD 83
2004	543390	5432919	12U	NAD 27		2005	545739	5431709	12U	NAD 83
2004	543529	5433147	12U	NAD 27		2005	543413	5432892	12U	NAD 83
2004	544177	5432760	12U	NAD 27		2005	545973	5431554	12U	NAD 83
2004	545108	5432356	12U	NAD 27		2005	540671	5436533	12U	NAD 83
2004	545684	5430342	12U	NAD 27		2005	540532	5442484	12U	NAD 83
2004	544522	5431290	12U	NAD 27		2005	545417	5432381	12U	NAD 83
2004	540954	5444801	12U	NAD 27		2005	545989	5431545	12U	NAD 83
2004	545945	5431378	12U	NAD 27		2005	544918	5434597	12U	NAD 83
2004	546344	5430524	12U	NAD 27		2005	536038	5440556	12U	NAD 83
2004	544577	5431945	12U	NAD 27		2005	546443	5430380	12U	NAD 83
2004	540131	5436585	12U	NAD 27		2005	546178	5429946	12U	NAD 83
2004	542176	5433404	12U	NAD 27		2005	541925	5441448	12U	NAD 83

APPENDIX 5. UTM Co-ordinates for the location of Loggerhead Shrike nests at Onefour in 2005

LATITUDE	LONGITUDE	DAY	MON	YEAR	NO. LOSH OBS'N	Age/Sex	Nest contents	COMMENTS/ Observers
539138	5439519	12	6	2005	2	2 AD	6 young	Gravel Road east of station road/ GLH/HET
538806	5439900	12	6	2005	1	1 AD	1 egg	Gravel Road at station road/ GLH/HET
536938	5440405	12	6	2005	1	1 AD	7 eggs	Gravel Road west of station road/ RK/GLH/HET
538784	5441320	13	6	2005	2	2 AD	no	Near pond North of Station/ RK
538784	5441320	23	6	2005	2	2 AD	1+ large young	Near pond North of Station/ HET
541694	5435659	14	6	2005	2	2 AD	yes,not visited	Sheep Camp/ HET
540065	5435656	23	6	2005	1	1 AD	no	Al Camp - N-S trail towards Cow Camp/ RK
533990	5439435	22	6	2005	1	AD	no	Gravel Road west of station road, by a deep ditch, in willow patch? And adult would not leave patch/ RK

APPENDIX 6. UTM Co-ordinates for the location of Sprague's Pipit sightings at Onefour in 2002, 2003 and 2005

YEAR	EASTING	NORTHING	ZONE	# SEEN		YEAR	EASTING	NORTHING	ZONE	# SEEN
2002	539988	5443172	12U	1		2005	540516	5437801	12U	1
2002	540323	5444268	12U	2		2005	540008	5438735	12U	2
2002	540928	5443794	12U	1		2005	539134	5439578	12U	2
2002	541442	5442485	12U	1		2005	538323	5440244	12U	1
2002	539586	5442072	12U	1		2005	535833	5440412	12U	1
2002	539442	5441650	12U	1		2005	535240	5440410	12U	1
2002	539420	5441363	12U	1		2005	533621	5438922	12U	1
2002	540357	5436736	12U	1		2005	532641	5438887	12U	1
2002	544096	5435221	12U	1		2005	536763	5440438	12U	2
2003	545844	5432066	12U	2		2005	536528	5441257	12U	2
2003	546694	5432075	12U	1		2005	535806	5441826	12U	2
2003	546638	5432969	12U	1		2005	535319	5442198	12U	2
2003	546632	5433677	12U	1		2005	533794	5443141	12U	1
2003	545013	5433675	12U	1		2005	533270	5443390	12U	1
2003	545868	5432789	12U	2		2005	538315	5444584	12U	2
2003	546641	5431445	12U	1		2005	537528	5444322	12U	1
2003	546626	5429629	12U	1		2005	536984	5444060	12U	1
2003	539989	5443172	12U	1		2005	535624	5444065	12U	1
2003	540323	5444268	12U	2		2005	538804	5442061	12U	2
2003	540928	5443794	12U	1		2005	538671	5442908	12U	2
2003	541442	5442485	12U	1		2005	538499	5443599	12U	2
2003	539586	5407242	12U	1		2005	538404	5444216	12U	1
2003	539442	5441650	12U	1		2005	538485	5444964	12U	1
2003	539420	5441363	12U	1		2005	539235	5441079	12U	1
2003	539402	5440755	12U	1		2005	539861	5440478	12U	1
2003	540294	5440093	12U	1		2005	541874	5435813	12U	1
2003	540911	5439677	12U	1		2005	540086	5433027	12U	1
2003	541487	5439350	12U	1		2005	542125	5436894	12U	2
2003	542120	5438998	12U	1		2005	542556	5437883	12U	1
2003	540158	5431596	12U	1		2005	541794	5438280	12U	1
2003	543952	5428627	12U	1		2005	541292	5438496	12U	2
2003	544939	5428914	12U	1		2005	541058	5437851	12U	1
2003	545346	5429229	12U	1		2005	541545	5437375	12U	1
2003	545740	5429839	12U	1		2005	539727	5441446	12U	1
2003	538960	5442404	12U	1		2005	540151	5441875	12U	2
2003	539031	5443113	12U	1		2005	541524	5442128	12U	1
2003	538832	5444750	12U	1		2005	541348	5442894	12U	1
2003	539000	5444939	12U	1		2005	541083	5443765	12U	1

2003	539420	5445078	12U	1		2005	540175	5444338	12U	1
2003	539925	5447770	12U	1		2005	539977	5443588	12U	2
2003	539397	5443719	12U	1		2005	539402	5442054	12U	2
2003	540118	5445075	12U	1		2005	541286	5438601	12U	1
2003	541162	5445069	12U	1		2005	541619	5439189	12U	1
2003	541852	5445096	12U	1		2005	541409	5439571	12U	1
2003	542842	5443171	12U	1		2005	543788	5433041	12U	1
2003	545751	5430443	12U	1		2005	545723	5430088	12U	2
2003	538479	5438617	12U	1		2005	544863	5428857	12U	2
2003	538488	5438185	12U	1		2005	544068	5428602	12U	1
2003	546616	5429070	12U	2		2005	538387	5440153	12U	2
2003	545928	5428864	12U	3		2005	538418	5438541	12U	1
2003	546116	5428534	12U	1		2005	538420	5437754	12U	1
2003	546554	5428312	12U	2		2005	538435	5436885	12U	1
2003	546511	5427576	12U	1		2005	538441	5436159	12U	1
2003	545442	5427629	12U	1		2005	538450	5435364	12U	1
2003	544355	5427358	12U	1		2005	540065	5436191	12U	1
2003	544058	5427879	12U	1		2005	540063	5435427	12U	1
2003	544152	5428517	12U	1		2005	540072	5434628	12U	1
2003	543645	5430337	12U	1		2005	539419	5438175	12U	1
2005	545576	5434138	12U	1		2005	542094	5439088	12U	1
2005	544918	5434597	12U	1		2005	536082	5435349	12U	1
2005	544271	5435134	12U	2		2005	535652	5435981	12U	1
2005	543703	5435608	12U	2		2005	536830	5434559	12U	1
2005	543087	5436104	12U	2		2005	536823	5435351	12U	1
2005	542182	5436567	12U	2		2005	536819	5436166	12U	1
2005	541428	5437167	12U	1		2005	538040	5436378	12U	1

APPENDIX 7. UTM Co-ordinates for the location of Long-billed Curlew sightings at Onefour in 2002, 2003 and 2005

YEAR	EASTING	NORTHING	ZONE	# SEEN
2002	539420	5441362	12U	1
2003	545844	5432[illegible]	12U	3
2003	546694	5432075	12U	2
2003	546626	5429629	12U	3
2003	539420	5441363	12U	1
2003	540108	5432441	12U	1
2003	540158	5431596	12U	1
2003	543391	5432328	12U	3
2003	545442	5427629	12U	2
2005	544918	5434597	12U	2
2005	544271	5435134	12U	2
2005	543087	5436104	12U	1
2005	539235	5441079	12U	2
2005	541701	5434349	12U	1
2005	541147	5433972	12U	2
2005	540390	5433966	12U	2
2005	539599	5433961	12U	2
2005	540086	5433027	12U	1
2005	540103	5432175	12U	2
2005	540213	5431390	12U	2
2005	540462	5430583	12U	2
2005	540582	5429980	12U	2
2005	540573	5428722	12U	2

YEAR	EASTING	NORTHING	ZONE	# SEEN
2005	542556	5437883	12U	2
2005	539727	5441446	12U	2
2005	541286	5438601	12U	2
2005	540172	5440321	12U	1
2005	542524	5433961	12U	2
2005	543788	5433041	12U	2
2005	544425	5432565	12U	2
2005	544990	5432123	12U	2
2005	545674	5430833	12U	4
2005	545723	5430088	12U	2
2005	544863	5428857	12U	2
2005	544068	5428602	12U	2
2005	542754	5428729	12U	2
2005	541977	5429076	12U	2
2005	541227	5429240	12U	2
2005	538450	5435364	12U	2
2005	540072	5434628	12U	2
2005	539471	5437458	12U	2
2005	536456	5434647	12U	1
2005	535082	5436568	12U	2
2005	538162	5433624	12U	2
2005	537695	5433104	12U	2

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